

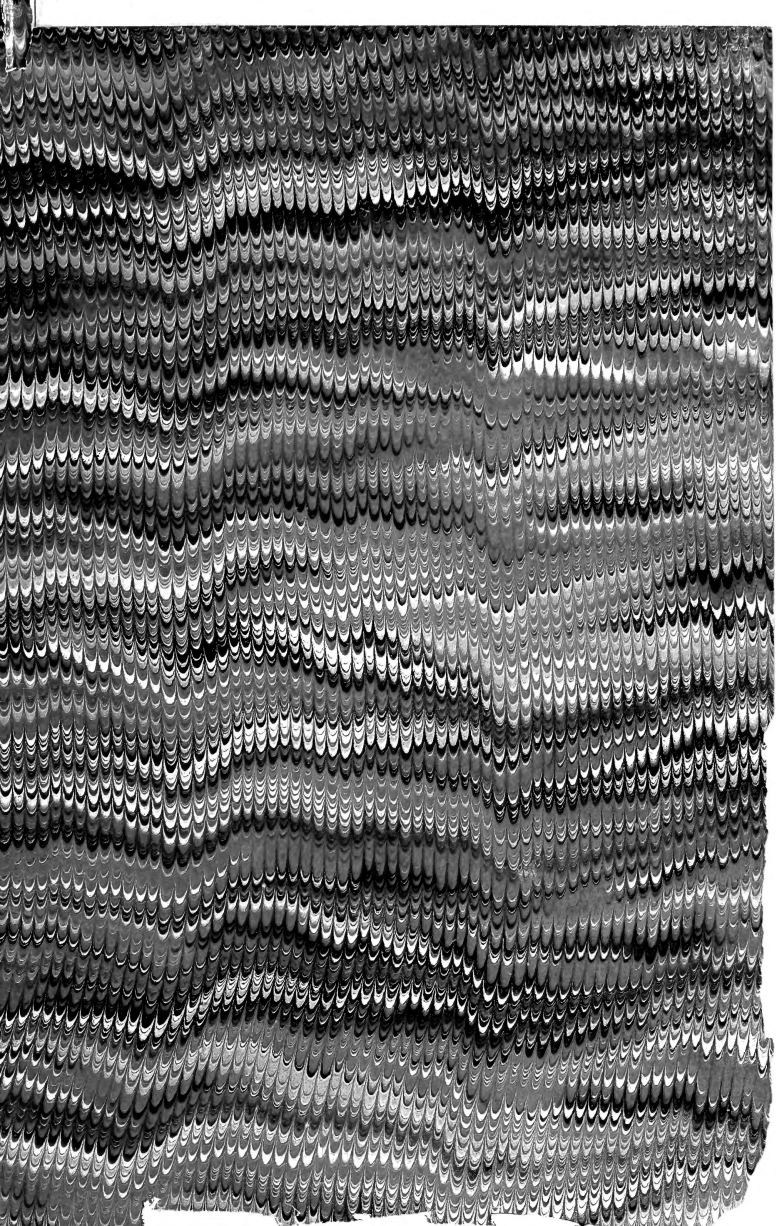
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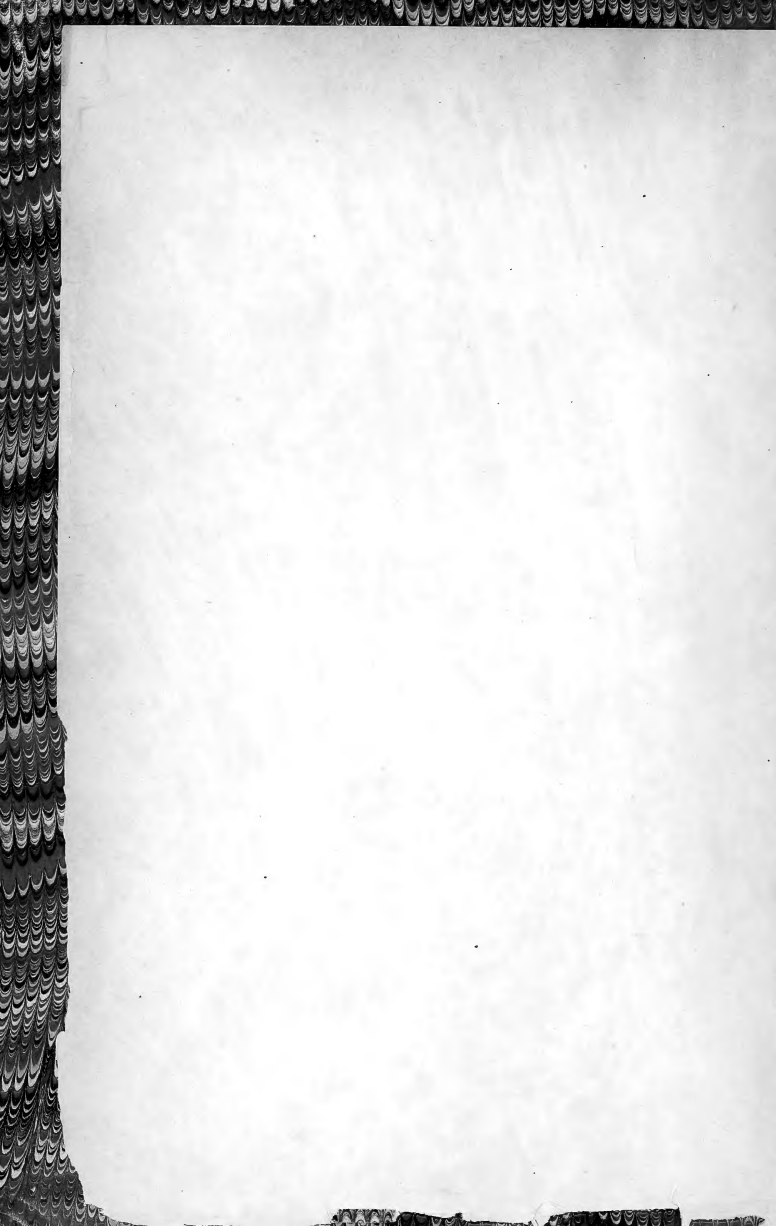
AT HARVARD COLLEGE, CAMBRIDGE, MASS.

Founded by private subscription, in 1861.

The gift of *Prof. L. Agassiz.*

No. 3288.





ILLUSTRATED CATALOGUE

OF THE

MUSEUM OF COMPARATIVE ZOÖLOGY,

AT HARVARD COLLEGE.

Published by order of the Legislature of Massachusetts.

No. I.

OPHIURIDÆ AND ASTROPHYTIDÆ.

BY

THEODORE LYMAN.

CAMBRIDGE:
FOR SALE BY SEVER AND FRANCIS.
1865.

UNIVERSITY PRESS: WELCH, BIGELOW, & CO.,
CAMBRIDGE.

THE publication of the Illustrated Catalogue of the Museum of Comparative Zoölogy has been undertaken with a threefold object. In the first place, like the catalogues of most institutions of a similar character, it is intended to make the contents of our Museum generally known, and to facilitate our exchanges. In the second place, to be the medium of publication of the novelties received at the Museum, which require to be described and illustrated by diagrams or wood-cuts, or more elaborate plates. Finally, it is hoped that it may be the basis of a systematic revision of such natural groups of the animal kingdom as are most fully represented in our collections, and that it may, as far as possible, present to the scientific world the results of the investigations carried on in the Museum with a view of ascertaining the natural limits of the Faunæ at the present time and in past ages, and the genetic relations which may exist between the order of succession of organized beings upon the earth, their mode of growth, and their metamorphoses during their embryonic life, and the plan and complication of their structure in their adult condition.

The means for publishing this work have been most liberally granted by the Legislature, at a time when, in a less enlightened assembly, the material cares of the community would have engaged their exclusive attention.

L. AGASSIZ.

CAMBRIDGE, *March* 28, 1865.

P R E F A C E.

THIS is a descriptive Catalogue of such Genera and Species of Ophiuridæ and Astrophytidæ, from the shores of North and South America and of Greenland, as are now represented in the Smithsonian Institution (1861) and in the Museum of Comparative Zoölogy at Harvard University (1864). To these are added notices of the other species in our Museum.

There are twenty-six genera in all, and one hundred and five species. Of these, five genera and twenty-six species are new; also, one generic name, which could not stand, has been replaced by a new one.

The Catalogue consists of a Preface, an Introduction, a List of the most important books, a Table of the known Species of Ophiuridæ and of Astrophytidæ, and descriptions of Genera and Species of the families Ophiuridæ and Astrophytidæ.

I take this opportunity to thank the following gentlemen for their kind assistance in giving me specimens, and a great variety of valuable information: Professor Henry, Secretary of the Smithsonian Institution; Professor S. F. Baird; Professor F. S. Holmes; Professor J. Leidy; Dr. J. L. LeConte; Dr. Wm. Stimpson; Professor Steenstrup and Dr. C. F. Lütken, of Copenhagen; Dr. D. F. Weinland; James M. Barnard, Esq.; Rev. J. E. Mills; Mr. T. N. Gill; Mr. Higginson; Mr. A. S. Packard, Jr.; Mr. N. S. Shaler; Professor A. E. Verrill; Mr. A. Garrett; Mr. G. A. Cheney, of Zanzibar; Mr. C. Curtis, of Key West; Dr. Whitehurst, Surgeon of the post, and Mr. Phillips, Superintendent at Fort Jefferson, Tortugas; General Geo. G. Meade, U. S. A.; General D. P. Woodbury, U. S. A.; Lieutenant Craighill, U. S. A.; Mr. A. H. Riise, of St. Thomas; Professor Valenciennes and M. Rousseau, of the Jardin des Plantes; Professor Schmarda, of Vienna; Professor Schlegel and Professor Herklots, of

Leyden ; Dr. Strahl, of Berlin ; Professor Owen and Dr. Gray, of the British Museum ; and Professor Allman, of Edinburgh. To my friend, Mr. Alex. Agassiz, I wish especially to make my acknowledgments for the tedious labor of correcting the proofs, which he has cheerfully undertaken during my unavoidable absence. Professor Agassiz has, in the kindest manner, superintended the work.

THEODORE LYMAN.

CAMBRIDGE, MASS., *October*, 1864.

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INTRODUCTION.

AS this is neither a treatise on the anatomy of serpent-stars, nor a critical essay on their classification, no parts are treated of that do not bear directly on specific and generic relations.

Without entering upon the metaphysical questions of the existence, limits, and relations of genera and of species, I have tried, as far as might be, to keep the characters strictly separate, and not to mingle generic marks in specific descriptions, or *vice versa*.

Although the names which are commonly used for the different organs by no means express their true homologies, but, on the contrary, are mostly names applied originally to anatomical parts among Vertebrata, I have nevertheless held to the received nomenclature, because any change would have to be explained by a chapter on the homologies of Radiata, which could not be here admitted.

Method of describing.—An Ophiuran, to be “in position,” should be placed with the mouth down; then, horizontally towards the points of the arms, is *outwards*; horizontally towards the mouth, is *inwards*; vertically towards the back, or upper surface of the animal, is *upwards*; vertically towards the mouth and under surface of the animal, is *downwards*. It is essential that these directions should be borne in mind.

It should not be forgotten that these animals are, at different stages of growth, quite unlike in the number, size, and proportions of their parts; and that even the full-grown ones present a compound of young and of adult characters, since the outer part of the arm is made up of joints not yet fully developed. Hence it is necessary, in determining different species, that specimens of the *same size* should be compared with each other. Considering these differences, it is proper to state, that, when “arm-plates,” “arm-joints,” &c. are spoken of, without further qualification, in the following descriptions, it means only such as are near the base of the arm, and are therefore fully grown. Also, where the “length” or the “breadth” of a part is mentioned, the *greatest* length, or breadth, is referred to.

The millimeter is always used as the unit of measurement; there-

fore, all measurements in these descriptions may be directly compared with each other, and proportions, or tables, may be made from them.

All the species are described in the same way, and in accordance with the following table:—

1. NAMES.
2. PRINCIPAL SYNONYMES, with references to their authorities. These have been taken from the original works, whenever it was possible.
3. SPECIAL MARKS. A few striking characters are given, to aid the student in finding a particular species.
4. DESCRIPTION OF A SPECIMEN.¹ A specimen is particularly described, *as an individual*, and without reference to other individuals. Its parts are taken up in the following order:—
 - a. *General measurements.* Diameter of the disk. Distance from the outer edge of a mouth-shield² (Fig. 9, *a*) to the outer corner of the opposite mouth-slit.³ Width of an arm, without its spines. Length of an arm. Distance from the outer side of a mouth-shield to the inner point of the corresponding angle of the mouth (Fig. 15, *c*), compared with the distance between the outer corners of two mouth-slits.
 - b. *Chewing apparatus.* Number, shape, size, &c. of the mouth-papillæ (Fig. 15, *d*); tooth-papillæ⁴ (Fig. 5, *d'*); and teeth⁵ (Fig. 5, *d''*).
 - c. *Mouth-shields*, their shape, and length to breadth; peculiarities of the madreporic shield.
 - d. *Side mouth-shields*⁶ (Fig. 9, *b*), their size and shape.
 - e. *Under arm-plates*⁷ (Fig. 3, *h*), their shape, size, and proportions. These plates are often octagonal, in which case the two sides that are parallel with the length of the arm are called *lateral* (Fig. 11, *h'''*); the two that run across the arm, *outer* (Fig. 11, *h''*) and *inner*; and the four sides that stand at an angle with the length of the arm, respectively *outer lateral* and *inner lateral* (Fig. 11, *h'* and *h'''*). In counting the joints, or the plates, of the arm, the innermost under arm-plate (which is often quite rudimentary) is considered as the *first*.
 - f. *Side arm-plates*⁸ (Fig. 3, *i*), their form and character.
 - g. *Upper arm-plates*⁹ (Fig. 2, *j*), their shape, size, and proportions. Their different sides are named in the same way as those of the under arm-plates. In some genera these plates have *supplementary pieces*, which are always placed near the edges, but vary in number, size, and shape.
 - h. *Disk*, details of its covering, above and below. The disk is divided into *brachial* and *interbrachial spaces*, the former including the sectors, which contain the arms, the latter those which are between the arms. When the scaly coat is not entirely covered by grains, or spines, there may be distinguished certain

¹ For a short anatomical description, see Lütken on Ophiurans, Silliman's Journal, XXVIII. July, 1859.

² Mundschild (Müll.) Scutum buccale (Müll.).

³ Mundspalten (Müll.) Rima oris.

⁴ Zahnpapillen (Müll.) Papillæ dentales.

⁵ Zähne (Müll.) Dentes.

⁶ Scutella adoralia.

⁷ Bauchschilder (Müll.) Scutella ventralia.

⁸ Scutella lateralia.

⁹ Rückenschilder (Müll.) Scutella dorsalia.

principal scales, or plates; namely, *primary plates* (Pl. II. Fig. 5), which lie on the back of the disk, one in the centre, and others arranged along ten lines radiating from it; they may be distinguished by their greater size; in the young animal they cover the whole back of the disk, and are only six in number, — their number, size, shape, and position are described: — *radial shields*,¹⁰ their size, length to breadth, shape, &c.; these are plates, arranged in five pairs, a pair over the base of each arm (Fig. 10, *l*); among Astrophytidæ they are covered with thick skin, and extend nearly to the centre of the disk, forming radiating ridges, or “ribs”: — *radial scales* (Fig. 8, *m*), large scales sometimes found outside the radial shields: — *genital plates*, or *genital scales* (Fig. 4, *n*), which run along the genital slits, on the side next the inter-brachial space, — their size and shape.

i. Genital Slits (Fig. 17, *o*).

j. Arm-spines (Figs. 1 and 14, *p*), their special characters and their lengths, compared with each other and with the length of the lower arm-plate. The uppermost spine is counted as the *first*.

*k. Tentacle-scales*¹¹ (Fig. 15, *q*), their number, shape, size, &c.

l. Color. The colors of the animal, when alive and when in alcohol.

5. VARIATIONS OF THE SPECIES, in size, color, number of parts, &c.

6. LOCALITIES. In what seas found, and by whom, depth of water, habits, &c.

7. HOW DISTINGUISHED, specifically, from other species of the same genus.

8. LIST OF SPECIMENS now in the collections of the Smithsonian Institution, and of the Museum of Comparative Zoölogy at Cambridge.

¹⁰ *Scutella radialis*.

¹¹ *Papillæ ambulacrales*.

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LIST OF KNOWN SPECIES OF OPHIURIDÆ AND ASTROPHYTIDÆ.

NAME.	ORIGINAL NAME.	PRINCIPAL LOCALITIES.
Ophiura Lamk. (non Fbs.)		
<i>variegata</i> Lyman.	<i>Ophioderma variegata</i> Ltk.	West Coast of Central America.
<i>squamosissima</i> Lyman.	<i>Ophioderma squamosissima</i> Ltk.	West Indies.
<i>rubicunda</i> Lyman.	<i>Ophioderma rubicunda</i> Ltk.	West Indies ; Florida.
<i>cinerea</i> Lyman.	<i>Ophioderma cinereum</i> Müll. & Tr.	West Indies ; Florida ; Gulf of Mexico.
<i>panamensis</i> Lyman.	<i>Ophioderma panamensis</i> Ltk.	West Coast Cent. Am. ; Lower Calif.
<i>Elaps</i> Lyman.	<i>Ophioderma Elaps</i> Ltk.	West Indies.
<i>brevicauda</i> Lyman.	<i>Ophioderma brevicauda</i> Ltk.	West Indies.
<i>guttata</i> Lyman.	<i>Ophioderma guttata</i> Ltk.	West Indies.
<i>olivacea</i> Lyman.	<i>Ophioderma olivaceum</i> Ayres.	S. side Cape Cod ; N. York ; N. Carolina.
<i>lævis</i> Lyman.	<i>Stella lævis</i> Rondel.	Mediterranean.
<i>Wahlbergii</i> Lyman.	<i>Ophioderma Wahlbergii</i> M. & Tr.	Port Natal, South Africa.
<i>brevispina</i> Say.	<i>Ophiura brevispina</i> Say.	West Indies ; Florida.
<i>appressa</i> Say.	<i>Ophiura appressa</i> Say.	West Indies ; Florida.
<i>teres</i> Lyman.	<i>Ophiura teres</i> Lyman.	West Coast Cent. Am. ; Lower Calif.
<i>Januarii</i> Lyman.	<i>Ophioderma Januarii</i> Ltk.	Rio Janeiro.
* <i>Grubii</i> Hell.	<i>Ophiura Grubii</i> Hell.	South Adriatic.
<i>Holmesii</i> Lyman.	<i>Ophiura Holmesii</i> Lyman.	Charleston, S. C.
Ophiocnemis Müll. & Trosch.		
<i>marmorata</i> Müll. & Tr.	<i>Ophiura marmorata</i> Lamk.	" Eastern Seas " ; Ceylon.
Ophiopeza Peters.		
<i>fallax</i> Peters.	<i>Ophiopeza fallax</i> Peters.	Mozambique ; Zanzibar.
<i>Yoldii</i> Ltk.	<i>Ophiopeza Yoldii</i> Ltk.	
Ophioglypha Lyman.		
<i>lacertosa</i> Lyman.	<i>Stella lacertosa</i> Linck.	North European Seas ; Mediterranean.
<i>albida</i> Lyman.	<i>Ophiura albida</i> Forbes.	North European Seas ; Mediterranean.
<i>carnea</i> Lyman.	<i>Ophiura carnea</i> Sars (MS.)	North European Seas.
<i>Sarsii</i> Lyman.	<i>Ophiura Sarsii</i> Ltk.	N. Europe ; Greenland ; N. E. America.
<i>affinis</i> Lyman.	<i>Ophiura affinis</i> Ltk.	North European Seas.
<i>robusta</i> Lyman.	<i>Ophiolepis robusta</i> Ayres.	N. Europe ; Greenland ; N. E. America.
<i>nodosa</i> Lyman.	<i>Ophiura nodosa</i> Ltk.	Greenland ; Labrador ; Newfoundland.
<i>Stucitzii</i> Lyman.	<i>Ophiura Stucitzii</i> Ltk.	Greenland ; Newfoundland.
<i>Lütkenii</i> Lyman.	<i>Ophioglypha Lütkenii</i> Lyman.	Puget Sound.
Ophiocten Ltk.		
<i>Krøyeri</i> Ltk.	<i>Ophiocten Krøyeri</i> Ltk.	Spitzbergen ; Greenland.
<i>abyssicola</i> Ltk.	<i>Ophiura abyssicola</i> Forbes.	Ægean Sea.
Ophiolepis Müll. & Trosch.		
<i>annulosa</i> Müll. & Tr.	{ <i>Ophiura annulosa</i> De Bl. } { (non Lamk.) }	{ Timor ; Celebes ; New Guinea ; Indian Ocean ; Red Sea ; Mozambique.
<i>variegata</i> Ltk.	<i>Ophiolepis variegata</i> Ltk.	West Coast of Central America.
<i>paucispina</i> Müll. & Tr.	<i>Ophiura paucispina</i> Say.	West Indies ; Florida.
<i>elegans</i> Ltk.	<i>Ophiolepis elegans</i> Ltk.	West Indies ; Florida.
<i>cincta</i> Müll. & Trosch.	<i>Ophiolepis cincta</i> Müll. & Tr.	{ Red Sea ; Mozambique ; East Ind. Ar- chipelago, Vavao ; New Guinea.
<i>Garretti</i> Lyman.	<i>Ophiolepis Garrettii</i> Lyman.	Kingsmills Islands.
* <i>stenura</i> Lor.	<i>Ophiolepis stenura</i> Lor.	Quarnero.
* <i>atacamensis</i> Phil.	<i>Ophiolepis atacamensis</i> Phil.	Isla Blanca, Chili.
Ophioceramis Lyman.		
<i>Januarii</i> Lyman.	<i>Ophiolepis Januarii</i> Ltk.	Rio Janeiro.

* Species marked thus * have not been revised by Mr. Lyman ; they have been added since his absence.

Ophiozona Lyman.*impressa* Lyman.*Ophiolepis impressa* Ltk.

West Indies; Florida.

pacifica Lyman.*Ophiolepis pacifica* Ltk.

West Coast of Central America.

Ophioplocus Lyman.*imbricatus* Lyman.*Ophiolepis imbricata* M. & Tr.

{ Kingsmills Islands; Mauritius; Mozambique; Nicobar Islands.

Ophiocoma Agass.*scolopendrina* Agass.*Ophiura scolopendrina* Lamk.

{ New Guinea; Zanzibar; Isle de France; Kingsmills Islands; Red Sea; Indian Ocean; Nicobar Isls.; Loo Choo Isls.

erinaceus Müll. & Tr.*Ophiocoma erinaceus* M. & Tr.

{ Sandwich Islands; Kingsmills Islands; Indian Ocean; Red Sea; Zanzibar.

Wendtii Müll. & Tr.*Ophiocoma Wendtii* Müll. & Tr.

South Sea.

Schoenleinii M. & Tr.*Ophiocoma Schoenleinii* M. & Tr.

Celebes.

Nilssonii Müll. & Tr.*Ophiocoma Nilssonii* Müll. & Tr.

North Sea.

nigra Müll. & Trosch.*Asterias nigra* O. F. Müll.

North European Seas.

tumida Müll. & Tr.*Ophiocoma tumida* Müll. & Tr.

Gulf of Genoa; Norway.

pica Müll. & Trosch.*Ophiocoma pica* Müll. & Tr.

{ Sandwich Isls.; Kingsmills Islands; Red Sea; Zanzibar; Mauritius; Java.

Valenciæ Müll. & Tr.*Ophiocoma Valenciæ* M. & Tr.

Red Sea; Mozambique.

squamata Müll. & Tr.{ *Ophiura squamata* Lamk. (non Delle Ch.) }

Atlantic Ocean.

picta Müll. & Tr.{ *Ophiura picta* Kuhl. & v. Has. (MS.) }

Java.

echinata Agass.*Ophiura echinata* Lamk.

West Indies; Florida.

brevipes Peters.*Ophiocoma brevipes* Peters.

Mozambique.

pumila Ltk.*Ophiocoma pumila* Ltk.

West Indies; Florida.

Rüsei Ltk.*Ophiocoma Rüsei* Ltk.

West Indies; Florida.

æthiops Ltk.*Ophiocoma æthiops* Ltk.

W. Coast Central Amer.; Lower Calif.

insularia Lyman.*Ophiocoma insularia* Lyman.

Sandwich Islands.

Alexandri Lyman.*Ophiocoma Alexandri* Lyman.

W. Coast Central Amer.; Lower Calif.

Ophiarachna Müll. & Trosch.*incrassata* Müll. & Tr.*Ophiura incrassata* Lamk.

Java.

infernalis Müll. & Tr.*Ophiarachna infernalis* M. & T.

Indian Ocean.

gorgonia Müll. & Tr.*Ophiarachna gorgonia* M. & T.

Mozambique.

septemspinosa M. & Tr.{ *Ophiura septemspinosa* Kuhl. & v. Has. (MS.) }

Molucca Islands.

vestita Lyman.*Pectinura vestita* Forbes.

Ægean Sea.

* ?

Pectinura Forbesii Hell.

South Adriatic.

Ophiomastix Müll. & Trosch.*annulosa* Müll. & Tr.*Ophiura annulosa* Lmk. (n. De Bl.)

Java.

venosa Peters.*Ophiomastix venosa* Peters.

Mozambique.

Ophiarthrum Peters.*elegans* Peters.*Ophiarthrum elegans* Peters.

Mozambique.

Ophioblenna Ltk.*antillensis* Ltk.*Ophioblenna antillensis* Ltk.

West Indies.

Ophiacantha Müll. & Trosch.*spinulosa* Müll. & T.*Ophiacantha spinulosa* Müll. & Tr.

N. Europe; Arctic Oc.; N.E. America.

setosa Müll. & Trosch.*Asterias setosa* Retz.

Sicily.

scabra Sars.*Ophiacantha scabra* Sars.

Mediterranean.

Ophiopholis Müll. & Trosch.*bellis* Lyman.{ *STELLA SCOLOPENDROIDES*; *bellis scolopendrica* Linck. }

{ Northern Europe; Arctic Sea; N. E. America.

Ophiopholis Müll. & Trosch. (*continued*).

Kennerlyi Lyman.
Caryi Lyman.

Ophiopholis Kennerlyi Lyman.
Ophiopholis Caryi Lyman.

Puget Sound ; Mendocino, Cal.
San Francisco, Cal.

Ophiostigma Ltk.

isocanthum Lyman.
tenuë Ltk.

Ophiura isocantha Say.
Ophiostigma tenuë Ltk.

West Indies ; Florida.
West Coast of Central America.

Ophiactis Ltk.

asperula Ltk.
Krøyeri Ltk.
Örstedii Ltk.
virescens Örst. & Ltk.
arenosa Ltk.
Reinhardtii Ltk.
Krebsii Ltk.
Mülleri Ltk.
sexradia Ltk.
simplex Ltk.
Ballii Sars.
virens Sars.

Ophiolepis asperula Phil.
Ophiactis Krøyeri Ltk.
Ophiactis Örstedii Ltk.
Ophiactis virescens Örsted. & Ltk.
Ophiactis arenosa Ltk.
Ophiactis Reinhardtii Ltk.
Ophiactis Krebsii Ltk.
Ophiactis Mülleri Ltk.
Ophiolepis sexradia Grube.
Ophiolepis simplex Le Conte.
Ophiocoma Ballii Thompson.
Ophiolepis (Ophiactis) virens Sars.

Chili.
West Coast of Central America.
West Coast of Central America.
W. Coast Cent. America ; Lower Calif.
West Coast of Central America.
Nicobar Islands.
West Indies ; Florida ; S. Carolina.
West Indies ; Florida.
Sandwich Islands.
West Coast of Central America.
English Coast ; Bergen.
Mediterranean.

Amphiura Forbes.

filiformis Forbes.
Holbollii Ltk.
Chiajii Forbes.
Puntarenæ Ltk.
microdiscus Ltk.
violacea Ltk.
Örstedii Ltk.
Rüsei Ltk.
Stimpsonii Ltk.
tenera Ltk.
geminata Ltk.
gracillina Ltk.
atra Ltk.
perplexa Lyman.
florifera Forbes.
squamata Sars.
urtica Lyman.
pugetana Lyman.
occidentalis Lyman.
punctata Ltk.
limbata Ltk.
chilensis Ltk.
Goodsiri.

Asterias filiformis O. F. Müller.
Amphiura Holbollii Ltk.
Amphiura Chiajii Forbes.
Amphiura Puntarenæ Ltk.
Amphiura microdiscus Ltk.
Amphiura violacea Ltk.
Amphiura Örstedii Ltk.
Amphiura cordifera Ltk.
Amphiura Stimpsonii Ltk.
Amphiura tenera Ltk.
Ophiolepis geminata Le Conte.
Ophiolepis gracillina Stimpson.
Ophiolepis atra Stimpson.
Ophiolepis perplexa Stimpson.
Amphiura florifera Forbes.
Asterias squamata Del. Chiaje.
Amphiura urtica Lyman.
Amphiura pugetana Lyman.
Amphiura occidentalis Lyman.
Ophiocoma punctata Forbes.
Ophiolepis limbata Grube.
Ophiolepis chilensis Müll. & Tr.
Ophiocoma Goodsiri Forbes.

North European Seas.
Arctic Sea ; Greenland ; Spitzbergen.
North European Seas ; Mediterranean.
West Coast of Central America.
West Coast of Central America.
West Coast of Central America.
West Coast of Central America.
West Indies.
West Indies.
West Indies ; South Carolina.
West Coast of Central America.
South Carolina.
South Carolina.
Port Jackson, Australia.
Ægean Sea.
{ Grand Manan, Massachusetts Bay ;
Mediterranean ; England ; Denmark.
Puget Sound.
Puget Sound ; Mendocino, Cal.
Monterey ; Mendocino ; Puget Sound.
English Coast.
Rio Janeiro.
Chili.
English Coast.

Ophiophragmus Lyman.

marginatus Lyman.
septus Lyman.
Wurdemani Lyman.

Amphiura marginata Örst. & Ltk.
Amphiura septa Ltk.
Amphiura Wurdemani Lyman.

West Coast of Central America.
West Indies.
West Coast Florida.

Ophiocnida Lyman.

brachiata Lyman.
scabriuscula Lyman.
hispida Lyman.
neapolitana Lyman.
Ballii Lyman.
abyssicola Lyman.

Asterias brachiata Montagu.
Amphiura scabriuscula Ltk.
Ophiolepis hispida Le Conte.
Amphiura neapolitana Sars.
Amphiura Ballii Sars.
Amphiura abyssicola Sars.

English Coast.
West Indies.
West Coast of Central America.
Mediterranean.
Norway.
Norway.

Hemipholis Agass. (MS.)

cordifera Lyman. *Asterias cordifera* Bosc. South Carolina.

Ophionereis Ltk.

<i>dubia</i> Lyman.	<i>Ophiotepis dubia</i> M. & T. (Savig.)	Red Sea.
<i>reticulata</i> Ltk.	<i>Ophiura reticulata</i> Say.	West Indies ; Florida.
<i>annulata</i> Lyman.	<i>Ophiotepis annulata</i> Le Conte.	West Coast of Central America.
<i>Schayeri</i> Ltk.	<i>Ophiotepis Schayeri</i> Müll. & Tr.	Van Diemen's Land.
<i>Xantusii</i> Lyman.	<i>Ophionereis Xantusii</i> Lyman.	Lower California.
<i>porrecta</i> Lyman.	<i>Ophionereis porrecta</i> Lyman.	Florida.

Ophiopeltis Dübén & Koren.

securigera Düb. & Kor. *Ophiopeltis securigera* Düb. & K. Baltic Sea.

Ophiopsila Forbes.

<i>arana</i> Forbes.	<i>Ophiopsila aranea</i> Forbes.	Mediterranean.
<i>annulosa</i> Ltk.	<i>Ophianoptus annulosus</i> Sars.	Mediterranean.
<i>Rüsei</i> Ltk.	<i>Ophiopsila Rüsei</i> Ltk.	West Indies; Florida.

Ophiothrix Müll. & Trosch.

<i>spiculata</i> Le Conte.	<i>Ophiothrix spiculata</i> Le Conte.	West Coast of Central America.
<i>rosula</i> Forbes.	{ <i>STELLA SCOLOPENDROIDES</i> ; <i>rosula scolopendroides</i> Linck. }	Mediterranean ; N. European Seas.
<i>hirsuta</i> Müll. & Tr.	<i>Ophiothrix hirsuta</i> Müll. & Tr.	Red Sea.
<i>comata</i> Müll. & Tr.	<i>Ophiothrix comata</i> Müll. & Tr.	
<i>longipeda</i> Müll. & Tr.	<i>Ophiura longipeda</i> Lamk.	{ Society Islands ; Timor ; Nicobar Isl- ands ; Isle de France.
<i>Rammelsbergii</i> M. & T.	<i>Ophiothrix Rammelsbergii</i> M. & T.	
<i>fumaria</i> Müll. & Tr.	<i>Ophiothrix fumaria</i> Müll. & Tr.	
<i>triglochis</i> Müll. & Tr.	<i>Ophiothrix triglochis</i> Müll. & Tr.	Port Natal, South Africa.
<i>ciliaris</i> Müll. & Tr.	<i>Ophiothrix ciliaris</i> Müll. & Tr.	
<i>aspidata</i> Müll. & Tr.	<i>Ophiothrix aspidota</i> Müll. & Tr.	East Indies.
<i>nereidina</i> Müll. & Tr.	<i>Ophiura nereidina</i> Lamk.	South Sea.
<i>violacea</i> Müll. & Tr.	<i>Ophiothrix violacea</i> Müll. & Tr.	West Indies ; Rio Janeiro.
<i>spongicola</i> Stimpson.	<i>Ophiothrix spongicola</i> Stimpson.	Port Jackson, Australia.
<i>planulata</i> Stimpson.	<i>Ophiothrix planulata</i> Stimpson.	Groper Shoal, S. lat. 20°, E. lon. 160½.
<i>Örstedii</i> Ltk.	<i>Ophiothrix Örstedii</i> Ltk.	West Indies ; Florida.
<i>Suensonii</i> Ltk.	<i>Ophiothrix Suensonii</i> Ltk.	West Indies ; Gulf of Mexico.
<i>lineata</i> Lyman.	<i>Ophiothrix lineata</i> Lyman.	Florida.
<i>angulata</i> Ayres.	<i>Ophiura angulata</i> Say.	South Carolina ; Georgia.
<i>alba</i> Grube.	<i>Ophiothrix alba</i> Grube.	Atlantic Ocean.
<i>magnifica</i> Lyman.	<i>Ophiothrix magnifica</i> Lyman.	Chili.
<i>dumosa</i> Lyman.	<i>Ophiothrix dumosa</i> Lyman.	Gulf of California.
<i>parasita</i> Müll. & Tr.	<i>Ophiothrix parasita</i> Müll. & Tr.	Australia.
<i>virgata</i> Lyman.	<i>Ophiothrix virgata</i> Lyman.	Kingsmills Islands.
<i>propinqua</i> Lyman.	<i>Ophiothrix propinqua</i> Lyman.	Kingsmills Islands.
<i>Cheneyi</i> Lyman.	<i>Ophiothrix Cheneyi</i> Lyman.	Zanzibar.
<i>demessa</i> Lyman.	<i>Ophiothrix demessa</i> Lyman.	Kingsmills Islands ; Sandwich Islands.

Ophiomyxa Müll. & Trosch.

<i>pentagona</i> Müll. & Tr.	<i>Ophiura pentagona</i> Lamk.	Mediterranean.
<i>flaccida</i> Ltk.	<i>Ophiura flaccida</i> Say.	West Indies; Florida.

Ophioscolex Müll. & Trosch.

glacialis Müll. & Tr. *Ophioscolex glacialis* Müll. & Tr. Spitzbergen.

Asteronyx Müll. & Trosch.

Loveni Müll. & Trosch. *Asteronyx Loveni* Müll. & Tr. Norway.

Trichaster Agass.

<i>palmiferus</i> Agass.	<i>Euryale palmiferum</i> Lamk.	India.
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Astrophyton Linck.

<i>arborescens</i> Müll. & Tr.	<i>Stella arborescens</i> Rondel.	Mediterranean.
<i>Lamarckii</i> Müll. & Tr.	<i>Astrophyton Lamarckii</i> M. & Tr.	North European Seas.
<i>eucnemis</i> Müll. & Tr.	<i>Astrophyton eucnemis</i> M. & Tr.	Greenland.
<i>Caryi</i> Lyman.	<i>Astrophyton Caryi</i> Lyman.	San Francisco, Cal.
<i>Agassizii</i> Stimpson.	<i>Astrophyton Agassizii</i> Stimps.	Cape Cod, Ms., to Gulf St. Lawrence.
<i>Linckii</i> Müll. & Tr.	<i>Astrophyton Linckii</i> Müll. & Tr.	North European Seas.
<i>clavatum</i> Lyman.	<i>Astrophyton clavatum</i> Lyman.	Zanzibar.
<i>costosum</i> Seba.	<i>Astrophyton costosum</i> Seb. (n.Ltk.)	Florida; West Indies.
<i>cæcilia</i> Ltk.	<i>Astrophyton cæcilia</i> Ltk.	West Indies.
<i>Krebsii</i> Ltk.	<i>Astrophyton Krebsii</i> Ltk.	West Indies.
<i>chilense</i> Phil.	<i>Astrophyton chilense</i> Phil.	Chili.
<i>verrucosum</i> Müll. & Tr.	<i>Euryale verrucosum</i> Lamk.	Indian Ocean.
<i>asperum</i> Agass.	<i>Euryale asperum</i> Lamk.	India.
<i>exiguum</i> Agass.	<i>Euryale exiguum</i> Lamk.	South Sea.

Asteroporpa Örsted.

<i>annulata</i> Örst. & Ltk.	<i>Asteroporpa annulata</i> Örst. & Ltk.	West Indies.
<i>affinis</i> Ltk.	<i>Asteroporpa affinis</i> Ltk.	West Indies.
* <i>dasycladia</i> Duj. & H.	<i>Trichaster dasycladia</i> Val. MS.	Guadaloupe.

Asterochema Örsted.

<i>oligacis</i> Ltk.	<i>Asterias oligactes</i> Pallas.	West Indies.
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DOUBTFUL SPECIES.

Ophiura cuspidifera Lamk.

Astrophyton costosum, *costis conicis* Linck.

Astrophyton scutatum, *scuto striato* Linck.

Astrophyton scutatum, *scuto rotato* Linck.

Stella scolopendroides granulata Linck.

Erste Sternfisch F. Martens.

Ander Sternfisch F. Martens.

Ophiocoma erinaceus ? *Ophiocoma echinata* ?

Ophiopholis ?

Astrophyton ?

GEOGRAPHICAL DISTRIBUTION.

Despite the great additions to our knowledge of the two families of serpent-stars, we are scarcely yet in a position to do more than hint at the faunal distribution of the species. There is, so to speak, a fauna of the North Atlantic, whereof the extreme limits are from the Mediterranean, on the east, to Cape Cod, on the west. The *Amphiura squamata* is found over this whole range; and even of *Ophiopholis bellis* I have seen a specimen from Fayal. This last species swarms in all the northern part of this faunal region, from east to west; *Ophioglypha robusta*, *O. Sarsii*, and *O. nodosa* are common to the two sides of the Atlantic, as well as *Ophiocantha spinulosa*; while *Ophiothrix rosula*,

though ranging from the Mediterranean to the Arctic seas, does not pass to the western side. *Astrophyton Agassizii*, on the other hand, is a purely American species. So that the two sides of this region, though agreeing in many things, are distinguished in others. Thus, the genera *Ophiothrix* and *Ophiocoma* are quite wanting along the northeastern shores of America. After passing Cape Cod, we find, to the south, the genus *Ophiura*, but only one species, the northern species of various genera disappearing, and a barren tract succeeds as far as North Carolina, in which space I know of but one Ophiuran, *Ophiura olivacea*, as a common resident. Once in the latitude of Charleston, South Carolina, we meet a rich store of species, and encounter the genera *Amphiura*, *Hemipholis*, and *Ophiothrix* in abundance; not, however, the same species that occur in the Gulf of Mexico and among the Antilles, in which narrow circle lives a distinct fauna, of surpassing richness; — there may be seen the myriads of *Ophiothrix Örstedii*, *Ophiocoma echinata*, *Ophiura appressa*, and *Ophiopsila Rüsei*; while in the deeper waters we have the curious forms of *Asterochema* and *Asteroporpa*. The development of the genus *Ophiura* is especially remarkable, and quite characteristic. Passing the narrow isthmus, to the Pacific coast of Central America, we light upon a distinct fauna again, but one which is a counterpart of that of the Gulf. The same forms of *Ophiothrix*, *Ophiocoma*, *Ophionereis*, and *Ophiura*. Following this coast to the north, we in due time arrive at a temperate fauna, in the region of Northern California. There, again, is a *souvenir* of the eastern coast; the characteristic *Ophiopholis*, the *Amphiura pugetana*, and even an *Astrophyton*, which recalls *A. eucnemis*. Striking now westward, and getting to the Sandwich Islands, we are on the borders of what may be termed the fauna of the great ocean, a fauna presenting in its vast range the greatest contrast to that of the Gulf of Mexico. This region extends from the Red Sea and Zanzibar, on the west, to the Sandwich Islands, on the east; and from the Kingmills group, on the south, to the Loo-Choo Islands, on the north! New forms here surprise us; *Ophiopeza* replacing *Ophiura*, which is unknown; then *Ophiarachna*, *Ophiomastix*, and *Ophiarthrum*; while, on the other hand, the already familiar *Ophiocoma* and *Ophiothrix* are abundant, though with new features, as in *Ophiothrix longipeda*, or in *Ophiocoma pica*. *Amphiura* is almost wanting, but one *Ophionereis* occurs.

As to the faunæ of South Africa, Australia, and Southern South America, it is not well to speak, lest grave errors occur, from want of precise knowledge. I will merely mention that I saw in the collection of Professor Schmarda an *Ophioglypha* from New South Wales, — a very interesting hint on the correspondence of this fauna with the northern one.

one irregular in shape, longer than others; pointed; second one larger than those beyond, irregular, flattened; two innermost ones stout, conical; the rest fine, sharp, spine-like; teeth, five; lowest one sharp, conical; second and third flat, tapering; fourth flat, with nearly a square shape; uppermost one like second and third; mouth-shields triangular heart-shaped, point inward, inner sides a little re-enteringly curved, corners strongly rounded, length to breadth, 1.9:2.2; side mouth-shields, and space between mouth-shields and mouth-papillæ, covered by loose granulation; under arm-plates overlapping, about as long as broad; small compared with the width of arm; outer side curved, laterals re-enteringly curved, inner laterals short and a little sloping, inner side shorter than outer, and nearly straight; length to breadth (twelfth plate), 1.2:1.2. First plate has a lobed outer side, in consequence of two pores lying between it and second plates; plates just within margin of disk are, as usual, rather broader than those just beyond. The proportions of the twelfth plate are continued in those beyond, till near the end of the arm; the plates, however, grow more shield-shaped, and proportionately longer. Side arm-plates encroaching a little between both upper and under plates; upper arm-plates broader than long, thickened, somewhat irregular, sometimes broken, bounded without and within by more or less wavy lines; outer corners strongly rounded; inner side shorter than outer; length to breadth (seventh plate), 1.4:3.4; two thirds out on arm, same general shape; length to breadth, .9:1.8. First four plates enclosed by scaly prolongations of disk, and accordingly modified in shape; first plate quite rudimentary; disk entirely covered, except a few scales at base of arms, with comparatively coarse granulation, about thirty-six grains to a square *mm.*; arm-spines, nine, of nearly equal length, unusually short, stout, and thick; length near base of arm to length of under arm-plate, .7:1.2; the spines are pointed, and but little flattened; tentacle-scales; inside one long, oval; length to that of under arm-plate, .7:1.2; outside one shorter, broader, and cut off at its end; color, in alcohol; above, light yellowish-brown, disk finely speckled with dull sap-green, arms irregularly blotched and banded with the same; below, ground-color same as above, but lighter, on arms and mouth-shields some traces of green.

Variations.—This species seems to fade in alcohol. It is then sometimes quite white; but dry specimens preserve the colors, more or less. These are various tints of sap-green, lake-red, and rusty-brown, much blended, and irregularly disposed. A common pattern is a brown disk above, greenish round the edges, upper surface of arms variously banded, spotted, and mottled, with many shades of green and red; interbrachial spaces, below, greenish brown, speckled with red, a red spot on each mouth-shield; under surface of arms similar to upper surface, but more

uniform and lighter. The length of the arms seems to average not more than three or three and a half times the diameter of the disk; thus, 20:63, 17:53, 16:45, 9:32. A specimen having a disk of 9^{mm} agreed entirely with the largest ones, except that the mouth-shields and arm-plates were a little less angular, and there were only eight arm-spines. Very often some of the naked scales at the base of the arms become so developed as to look like little thickened plates.

This species may be distinguished from other *Ophiuræ* with equal spines as follows:—*O. guttata* has the upper arm-plates divided in many little pieces, and has arm-spines of a different shape; *O. brevispina* has long oval mouth-shields, and the arm-spines much less stout; *O. Januarii* has only eight arm-spines, which are long and slender; *O. variegata* has longer arm-spines, and mouth-shields longer than broad.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
97	..	1	Tortugas, Fla.	Feb. 1856.	T. Lyman.	Alcoholic.
98	..	3	St. Thomas, W. I.	.....	A. H. Riise.	"
99	52	2	West Indies.	.....	Univ. Mus. Cop'hagen.	"
<i>Smithsonian Institution.</i>						
1078	..	1	St. Thomas, W. I.	.....	A. H. Riise.	Dried.
1081	..	2	St. Thomas, W. I.	.....	A. H. Riise.	"
1107	..	1	St. Thomas, W. I.	.....	A. H. Riise.	Alcoholic.
1151	..	2	St. Thomas, W. I.	.....	A. H. Riise.	Dried.

Ophiura brevispina SAY.

Ophiura brevispina SAY. Journ. Phil. Acad. V. 149. 1825.

Ophioderma serpens LÜTKEN. Addit. ad Hist. Oph. 96.

Special Marks.—Color usually greenish, sometimes tinged with reddish; sides of disk generally concave; diameter of disk about 12^{mm}; side mouth-shields naked; mouth-shields long heart-shaped.

Description of a Specimen.—Diameter of disk, 10.8^{mm}; outer edge of mouth-shield to outer corner of opposite mouth-slit, 4.6^{mm}; greatest width of arm, without spine, 2.5^{mm}; length of arm, 42.4^{mm}; distance from outer edge of mouth-shield to inner point of tooth-papillæ to that between outer corners of mouth-slits, as 2:2.2; mouth-papillæ, usually sixteen to each angle of mouth; outermost one small, and often partly concealed; innermost ones pointing nearly to centre of mouth, spearhead-shaped, and longer and broader than the rest; teeth, five, shaped like a flat, blunt, spearhead; lowest one smallest; mouth-

shields long heart-shaped, the point inward; length to breadth, 1.4 : 1.2; madreporic shield wider, with an uneven surface; side mouth-shields, connecting first under arm-plate with mouth-shield, irregular, lengthened, triangular, swelled; under arm-plates hexagonal, with corners somewhat rounded; outer side of each plate overlapping inner side of its successor; first plate somewhat oval, with two notches in its outer side, where two pores enter, between it and the second plate; length to breadth, 6 : 12; second plate, outer side curved, lateral sides re-enteringly curved to receive tentacle-scales, inner side a little re-enteringly curved, with a small tongue running inwards under first plate; the third plate, and those just beyond, have a similar shape, but the outer curve may be broken up into three straight lines, of which one is the outer side proper, and the other two are the outer laterals; the inner side is bounded by two inner laterals, which start from tentacle pores and disappear under preceding plate; farther out, lateral sides become straighter, and outer side is a simple curve; near tip of arm, plates do not overlap, lateral sides are short and straight, while inner laterals are very long and gradually approach each other, to meet on the middle line of the arm; lengths to breadths as follows: second plate, 1 : 1; third plate, .8 : 1; tenth plate, .8 : 1; about two thirds out on arm, .6 : .4; close to tip of arm, .4 : .3. Side arm-plates do not meet above or below, even at tip of arm; the outer edge of each is on a line with the middle of an under arm-plate; above, they overlap the inner corners of upper arm-plates a little; upper arm-plates much broader than long; outer and inner sides nearly straight; lateral sides, being partly overlapped by side arm-plates, seem to slope from without inwards; third plate with outer and inner sides nearly straight; lateral sides sloping inwards; corners rounded; length, .8^{mm}; outer side, 1.8^{mm}; inner side, 1.4^{mm}; this is the typical shape of most of the upper arm-plates; fifteenth plate, length to breadth, .8 : 1.6; outer side curved; fortieth plate, length to breadth, .6 : 1.2; close to tip of arm, plates long heart-shaped, the point inward, length to breadth, 4 : 4; disk, above and below, together with spaces between mouth-shields and tooth-papillæ, evenly and closely covered with grains, about 260 to a square *mm*. Genital slits bounded by granulation of disk; between outer ones and side of arm may be seen grains and the edges of some scales. Arm-spines somewhat flattened, of nearly equal length, points rounded, length to that of under arm-plates, .6 : .8; sixth joint, five spines; seventh joint, six spines; eighth, ninth, and tenth joints, eight spines; eleventh joint, seven spines; about two thirds out on arm, six spines; close to tip of arm, three spines, shorter than joints, and more rounded than at base of arm. Tentacle-scales flat, with rounded ends, the one next to under arm-plate the larger; there are two to each tentacle, almost to the tip.

of the arm; length near base of arm, inside scale, .4, outside scale, .2. Color, in alcohol; disk, above, greenish gray (gamboge and neutral tint), clouded with lighter; upper side of arms very irregularly barred with several shades of greenish gray, and with dirty white; edges of upper arm-plates interrupted by very fine longitudinal streaks of darker, giving the appearance of teeth; edges of disk, below, same as above, its central portion, together with mouth apparatus, under surface of arms, and arm-spines, dirty white.

Variations.—This is a pretty uniform species. Its color is usually made up of several shades of sap-green, or of greenish gray, variegated with dirty white or yellow, the under parts being much lighter and less marked. Sometimes the green is replaced by lake-red. In specimens not yet fully grown, the upper arm-spine is often shorter than the others.

Ophiura brevispina differs from other equal-spined *Ophiuræ* as follows: from *O. brevicauda*, in longer and flatter spines and naked side mouth-shields; from *O. olivacea*, in more octagonal under arm-plates; from *O. guttata*, in having unbroken upper arm-plates; from *O. Januarii* and *O. variegata*, in shorter and differently-shaped arm-spines.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
89	..	12	Cape Florida.	Apr. 1858.	G. Wurdeman and J. E. Mills.	Alcoholic.
90	..	1	Tortugas, Fla.	Mar. 1, 1858.	G. Wurdeman and J. E. Mills.	
91	..	2	Cape Florida.	Feb. 1856.	T. Lyman.	"
92	..	3	Florida.	.....	Prof. Agassiz.	"
93	..	2	Florida.	.....	G. Wurdeman.	"
94	..	11	Cape Florida.	Apr. 1858.	G. Wurdeman and J. E. Mills.	"
95	..	2	West Indies.	.....	University Museum, Copenhagen.	"
96	..	1	Cape Florida.	.....	G. Wurdeman.	Dried.
<i>Smithsonian Institution.</i>						
1065	..	4	Florida.	.....	.....	Alcoholic.
1059	..	7	Cape Florida.	.....	G. Wurdeman.	"
989	..	1	Cape Florida.	1851.	.....	"
1086	..	2	St. Thomas & Bahamas.	.....	A. H. Riise.	"
1108	..	2	St. Thomas, W. I.	.....	A. H. Riise.	"

Ophiura Holmesii LYMAN. (Pl. I., Fig. 7.)

Ophioderma variegatum AGASS. MS.

Ophiura Holmesii LYMAN: Proceed. Boston Soc. Nat. Hist., VII. p. 255. 1860.

Special Marks.—Disk thick; arms stout, stiff; in length less than four times diameter of disk. Color, various patterns of white, and of different shades of green. No naked scales at base of arms.

Description of an Individual.—Diameter of disk, 19.2^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slits, 7.4^{mm}; greatest width of arm without spines, 4.4^{mm}; length of arm, about 74^{mm}; distance from outer edge of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 2.8:4.2^{mm}. Mouth-papillæ small, stout, rounded, pointed; from 16 to 18; outermost one somewhat longer than rest; one next to outermost, broad and flattened; two innermost pointing to centre, and somewhat longer than those near them. Teeth, four in number; uppermost one longer than others, flat, and sharp-pointed; three lower ones thin, flat, and with a rounded, cutting edge. Mouth-shields long heart-shaped, with point inward; on outer edge a slight indentation; length to breadth, 1.8:1.6^{mm}; madreporic shield shorter and broader, and with a small depression near outer edge. Side mouth-shields small, rounded, thickened, varying somewhat in shape, but commonly short, rounded, triangular; length to breadth, 1.2:1^{mm}; length to that of mouth-shields, 1.2:1.8^{mm}. Under arm-plates squarish; outer side curved, laterals a little re-enteringly curved, inner side and inner laterals short, of about equal length, and lying almost in one line; farther out on arm, inner laterals and inner side are very decidedly inclined to each other, and the curve of outer side is broken up into an outer side and two outer laterals, so that here the plates have the form of a nearly regular octagon; between first and second plates, and second and third plates, a pair of pores, separated by a little tooth. First plate very irregular oval, with a notch on its inner side; length to breadth, .8:1.4^{mm}. Second plate with a curved outer side, lateral and inner sides re-enteringly curved, the latter most so; length to breadth, 1:1.4^{mm}. Third plate, outer and inner sides curved, the latter the less; lateral sides re-enteringly curved; length to breadth, 1.2:1.6^{mm}. Fifth plate, same as third; about one third out on arm, plates octagonal, length to breadth, 1.2:1.4; near point of arm heart-shaped, with point inward. Side arm-plates compactly soldered with surrounding parts, stout, a little overlapped by upper plates, their outer edges showing plainly, by reason of shortness of arm-spines; they continue till quite near end of arm without meeting either above or below. Upper arm-plates much broader than long, outer corners rounded, inner

side a trifle shorter than outer side; incision in disk includes three plates; first plate rudimentary, in form of segment of a circle, with its curve inward, length to breadth, .8 : 1.2^{mm}; second plate similar in form, length to breadth, .8 : 1.8^{mm}; third plate similar in form, length to breadth, 1 : 3^{mm}; fourth plate of normal form, length to breadth, 1.2 : 3.2^{mm}; about two thirds out on arm, plates proportionately longer, outer corners much rounded, inner side shorter than outer so that lateral sides slope; length to breadth, 1 : 2^{mm}; length of inner side, 1.4^{mm}; close to tip of arm, plates wedge-shaped, the point inward, length to breadth, .4 : .4^{mm}, outer side slightly curved. Disk, granulation of upper surface pretty close and regular, about one hundred and eighty grains to a square *mm*.; granulation of interbrachial spaces below same as that above, and extending to bases of mouth-papillæ excepting side mouth-shields; scales at base of arm completely covered by granulation. Arm-spines short, stout, flat, rounded, varying very little in size on the same joint; upper ones, however, a little largest and longest. Second and third joints, three spines, lengths to that of under arm-plate, .8 : 1; fourth joint, four spines; fifth joint, five spines; sixth joint, six spines; seventh joint, eight spines; eighth joint, nine spines; length of uppermost and lowest spines to that of under arm-plate, .8, .8 : 1.2; a few of upper spines are as long as 1^{mm}; about two thirds out on arm, six spines, length to that of under arm-plate, .6 : 1; close to tip of arm, four very short, stout spines, length to that of under arm-plate, .4 : .6. Tentacle-scales: the two that belong to each tentacle continue till near tip of arm, where there is only one; inside scale much like an arm-spine, but broader and flatter; outside scale shorter, being cut square off at the end. Color, in alcohol: disk, above, with a dirty white patch in centre; rest of upper surface having a ground-tint of light yellowish-brown (yellow ochre and vandyke brown) slightly clouded with olive; arms above dirty olive, irregularly barred with same brown as ground-tint of disk, but lighter; bars include usually two or three joints; lower surface of disk and arms, uniform dirty white, with a brown tint just on edges of disk; arm-spines white.

Variations.—The color is almost as variable as in *O. appressa*. Often the disk is nearly white above, while the arms are dark green, and banded. According to drawings in possession of Prof. Agassiz, a common pattern in the living animal is a dark sap-green disk, with a blotch of white in the centre, and arms banded with darker and lighter green. Specimens with a disk of 14^{mm}. have the under arm-plates more octagonal and proportionately longer than among the larger.

This species stands between *O. brevispina* and *O. olivacea*; from the former it is distinguished by proportionately thicker arms and stouter disk, and by proportions of under arm-plates it is also a larger species,

twenty millimeters being about an average diameter for the disk of an adult ; from *O. olivacea* it is distinguished by its barred arms and varied coloration ; and from both of these by having no naked scales at the base of the arm.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
111	..	6	Charleston, S. C.	.....	Prof. Agassiz.	Alcoholic.
112	..	1	Sullivan's Island, S. C.	.....	Prof. Agassiz.	Dried.
113	..	3	Charleston, S. C.	.....	Prof. F. S. Holmes.	"

Ophiura olivacea LYMAN.

Ophioderma olivaceum AYRES ; Proceed. Boston Soc. Nat. Hist., IV. p. 134. 1852.

Special Marks. — Uniform greenish above, without bands on arms ; lower arm-plates nearly square, with outer side curved ; arms broad near base, quickly tapering ; side mouth-shields naked.

Description of a Specimen. — Diameter of disk, 11^{mm} ; from outer edge of mouth-shield to outer corner of opposite mouth-slit, 4.7^{mm} ; width of arm without spines, 2.2^{mm} ; length of arm about 52^{mm} ; distance from outer edge of mouth-shield to inner points of teeth, to that between outer corners of mouth-slits, 2.3 : 2.2. Mouth-papillæ sixteen, outer one small, next four stout, squarish, rounded ; innermost one longest, flat, and tapering ; the rest like innermost one, but smaller. Teeth five or six, similar among themselves, flat, tapering, pointed. Mouth-shields heart-shaped, with a truncated angle turned inward, and inner sides a little re-enteringly curved ; length to breadth, 1.5 : 1.5. Side mouth-shields small, and almost wholly naked, connecting innermost under arm-plate with mouth-shield. Under arm-plates squarish, rather broader than long, pretty strongly overlapping, bounded without by a long curve, within and on the sides by nearly straight lines, which are, however, slightly re-enteringly curved, length to breadth (twelfth plate), 6 : 8. As the plates overlap a good deal, the inner laterals are very short, while the outer laterals form a common curve with the outer side ; hence comes the characteristic, even, square look of the plates. First plate narrow oval, with a projection without, separating a pair of pores ; next three or four plates with rather longer inner laterals, and more curved outer sides, than those beyond ; about two thirds out on arm, plates no longer overlap, so that inner laterals are well developed, giving

the plates nearly an octagonal shape. Side arm-plates encroaching less than usual between lower arm-plates. Upper arm-plates broader than long, bounded, without and within, by very straight, clean lines; inner side shorter than outer; outer corners well rounded; three or four plates enclosed by projections from disk, and modified in form accordingly; length to breadth (sixth plate), .9:1.8; about two thirds out on arm, same general shape, but proportionately longer. Disk, except side mouth-shields and a very few naked scales at base of arm, closely covered with very fine grains, about 170 to a square *mm*. Arm-spines six, of equal length and size, somewhat flattened, but little tapering, points rounded; length to that of under arm-plate, .5:.6. Inside tentacle-scale oblong, with straight sides and rounded point; length to that of under arm-plate, .4:.6; outside scale shorter and broader. Color, in alcohol: above, uniform dark sap-green, without bands on the arms; below, the same, but lighter; interbrachial spaces slightly mottled, and of a darker shade than arms.

Variations.—The specimen above described is below the ordinary size of well-grown individuals. A specimen with a disk 14.5^{mm} in diameter had eight strongly flattened arm-spines, fifteen mouth-papillæ, and mouth-shields longer than broad, and pretty regular heart-shaped; disk with about 130 grains to a square *mm*. The number of teeth varies somewhat; four seems to be most common. A specimen with disk 16^{mm}, had arms 74^{mm}, and only seven arm-spines. The upper arm-spines are often, in large specimens, a little longer than the lower.

When alive, *O. olivacea* is of a bright green color. It lives on sandy bottom, among eel-grass, and is active in its motions (Ayres). It is, at first sight, very like *O. brevispina*, but is readily distinguished by more flattened arm-spines, and by the form of the under arm-plates, which are nearly square, with straight lateral sides, instead of hexagonal, with the lateral sides decidedly re-enteringly curved. It is further remarkable for uniformly colored arms without bands. Young or partly grown specimens, however, are often undistinguishable from *O. brevispina*. From other species with equal spines and covered radial shields, it is distinguished as follows: from *O. brevicauda*, by finer granulation and longer arm-spines; from *O. guttata*, by whole upper arm-plates; from *O. variegata*, by shorter arm-spines; and from *O. Januarii*, by shorter and broader arm-spines.

There is in the Philadelphia Academy a specimen, collected on the shores of Rhode Island by Prof. A. D. Bache, which agrees entirely with this species, except that it has *radial shields*. It is possible that the grains have been rubbed off the radial shields, after the animal was dry. Another specimen, in the Museum of Comparative Zoölogy at Cambridge, has, outside four of the mouth-shields little supplementary

mouth-shields, such as are found in *Ophiarachna*. It would seem that this species has variations similar to those of *O. longicauda*.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
100	..	2	New Bedford, Mass.	May, 1851.	Prof. Agassiz.	Alcoholic.
101	..	1	Dartmouth.	.....	Prof. Agassiz.	Dried.
102	..	1	Sag Harbor, L. I. ?	.....	Dr. Ayres ?	Alcoholic.
? 103	1193	2	Beaufort, N. C.	.....	Wm. Stimpson.	"
444	..	12+	Beaufort, N. C.	.....	A. S. Bickmore.	"
<i>Smithsonian Institution.</i>						
1048	..	1	Old Point Comfort, Va.	.....	.....	Alcoholic.
1193	..	12+	Beaufort, N. C.	.....	Wm. Stimpson.	"

Ophiura Januarii LYMAN.

Ophioderma Januarii LÜTKEN. Vidensk. Meddelelser. Jan., 1856.

Ophioderma Januarii LÜTKEN. Addit. ad Hist. Oph., p. 97.

Special Marks.—Arm-spines nearly as long as joints, round, slender; arms tapering, slender. Color, variegated greenish-gray, above; below, light straw-color. Side mouth-shields naked.

Description of a Specimen.—Diameter of disk, 17^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 7.2^{mm}; width of arm, without spines, 3.5^{mm}; length of arm, 82^{mm}; distance from outer side of mouth-shield to inner point of teeth, to that between outer corners of mouth-slits, 4:4. Mouth-papillæ sixteen to eighteen, of more even size than usual; second and third flat, squarish, with rounded edges; the rest rounded, spiniform, nearly equal. Teeth five; uppermost and lowest flat and tapering, the former longer; other three flat and square. Mouth-shields short heart-shaped; length to breadth about 1.7:2. Side mouth-shields broad, rather conspicuous, naked. Under arm-plates, near base of arm, broad octagonal, with four outer corners more or less rounded; length to breadth (eighth plate), 1:1.5; (twelfth plate), 1:1.3. First plate nearly oval, proportionately larger than usual; length to breadth, .8:1.3. About two thirds out on arm, the plates become nearly hexagonal, owing to encroachment of side arm-plates, which may be seen very plainly, both from above and from below. Upper arm-plates broader than long, bounded within and without by straight lines; inner side shorter; outer corners well rounded; three or four plates enclosed by projections from disk, and modified in

shape accordingly; length to breadth (sixth plate), 1.1 : 2.8. Disk evenly and finely, but not very closely, granulated throughout, except side mouth-shields, and a few naked scales at base of arm; about 80 grains to a square *mm*. Arm-spines very characteristic, eight (rarely nine) rounded, slender, slightly tapering, almost as long as joints, of even length and size; length to that of under arm-plate, .9 : 1. Inside tentacle-scale oblong, with a rounded end, rather delicate; length to that of under arm-plate, .7 : 1; outside scale of about the same width, but shorter, and cut off obliquely at the end. Color, in alcohol: above, disk dull greenish-gray round edges, fading to dull yellowish-brown towards centre; arms banded with darker and lighter shades of dull greenish-gray, each band occupying from two to five joints; outer edges of upper arm-plates finely marked with short, longitudinal lines of brown; below, uniform pale straw-color.

This delicate and elegantly formed species may at once be distinguished from other *Ophiura* with equal arm-spines and covered radial shields, by its long, rounded, slender arm-spines.

LIST OF SPECIMENS.

Catalogue Number.		Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
107	| 49	| 1	Brazil.	| . . . . .	Univ.Mus. Copenhagen.	Alcoholic.
<i>Smithsonian Institution.</i>						
1002	| . .	| 1	Brazil.	| . . . . .	Univ.Mus. Copenhagen.	Alcoholic.

Ophiura lævis LYMAN.

Stella lævis RONDELET. De Pisc. Mar., p. 120. 1554.

STELLA LUMBRICALIS; *Stella lævis* LINCK. De Stel. Mar., p. 46. 1733.

? *Stella lumbricalis longicauda* LINCK. De Stel. Mar., p. 47, tab. XI. fig. 17. 1733.

Ophiura lacertosa LAMK. Syst. Anim. s. Vertèb., p. 351. 1801.

Ophioderma longicauda MÜLL. & TROSC. Syst. Asterid., p. 86. 1842.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
114	| . .	| 1	. . . . .	| . . . . .	. . . . .	Dried.
411	| . .	| . .	Azores.	| . . . . .	. . . . .	Alcoholic.
426	| . .	| . .	Spain.	| . . . . .	Jardin des Plantes.	"
427	| . .	| . .	Alger.	| . . . . .	" " "	"

Ophiura cinerea LYMAN.

Ophioderma cinereum MÜLL. & TROSCHE. Syst. Asterid., p. 87. 1842.

Ophioderma Antillarum LÜTKEN. Addit. ad Hist. Oph., p. 88.

Special Marks. — A large species. In adult, upper arm-plates much broken; mouth-shields broad heart-shaped; mouth-papillæ crowded, numerous, and pretty equal (about twenty); arms very round, tapering.

Description of a Specimen. — Diameter of disk, 20^{mm}; from outer edge of mouth-shield to outer corner of opposite mouth-slit, 8^{mm}; greatest width of arm without spines, 4.2^{mm}; length of arm, 97^{mm}; distance from outer edge of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 4 : 4.4. Mouth-papillæ, nineteen to twenty-one to each angle of mouth (usually twenty), outer one very long and slender, running *above* next one or two papillæ, when mouth is tight shut; two innermost ones, pointing to centre of mouth, much stouter than others; of remaining papillæ, four inner ones somewhat weaker than four outer ones; all papillæ crowded, pointed, rounded. Teeth five, flat, somewhat blunt; the uppermost one longer and sharper. Mouth-shields short heart-shaped, point inward, well rounded, length to breadth, 1.8 : 2.2; madreporic shield more rounded, and somewhat larger, near its centre a rounded depression; side mouth-shields entirely covered by granulation. Under arm-plates thick, strong, and firmly set; bounded by a curved outer side, two long lateral sides a little re-enteringly curved, two very short inner laterals, and an inner side, nearly straight; towards end of arm, each plate is an octagon, its lateral sides being very long, and its outer and inner laterals very short; first plate small, irregular oval, with a slight peak inwards, length to breadth, .8 : 1.4; second plate, 1.2 : 1.4; eleventh plate, 1.2 : 1.4; about two thirds out on arm, length to breadth, 1.2 : 1; at tip of arm, plates nearly heart-shaped, with point inward. Side arm-plates thick, compact, closely soldered with surrounding parts, their outer edges very conspicuous by reason of shortness of arm-spines; not meeting above at all, and below only at very tip of arm. Upper arm-plates are all, with exception of first rudimentary one, and a few at tip of arm, broken in several pieces, irregular in form, and varying in number from two to five, according to size of plate; each plate, considered as a whole, makes a belt across arm, of which the inner side is shorter than the outer; incision in disk embraces first three plates, which are modified in shape accordingly; fourth plate, broken in four or five pieces, length to breadth, 1.2 : 3.6; about two thirds out on arm, some plates are found whole, but most are broken in two or three pieces; length to breadth, 1 : 2.6; close to tip of arm,

plates four-sided, outer side curved, and longer than inner side, length to breadth, .6 : .8. Disk : above, granulation very even, close, and fine, about one hundred grains to a square *mm*. Radial shields regular oval, standing nearly opposite outside lines of arms, quite smooth, length to breadth, 1.6 : 1.2 ; between radial shields and base of arm there are sometimes one or two rounded scales ; edges of incision in disk lined with small, thick, overlapping scales, varying in length from .2 to 1^{mm} ; at inner angle of incision these scales form a single row, but at outer angles they make a triangular cluster of six or seven rows, and are continued, over edge of disk, to its under surface, and reach as far as outer pair of genital slits ; they make, on under surface of disk, three irregular rows, interspersed with grains ; all other parts of interbrachial spaces, except mouth-shields, covered with a close granulation, quite to the bases of the mouth-papillæ. Genital slits, length of outer pair, 1.4^{mm}, of inner pair, 1.2^{mm}. Arm-spines short, stout, increasing in size from uppermost one to lowest, which is considerably the largest ; upper ones more pointed and rounded, lower ones more blunt and flattened ; second joint, two spines, length to that of lower arm-plate, .8, 1.2 : 1.2 ; seventh joint, five spines ; eighth joint, six or seven spines ; tenth joint, eight spines, .4, .6, .6, .8, .8, .8, 1, 1.2 : 1.2 ; about two thirds out on arm, six spines ; near tip of arm, four very short, thick, pointed spines. Tentacle-scales two, continued close to tip of arm ; inside one somewhat larger and longer, thin, cleanly rounded at end ; outside one similar, but cut off square at end ; length to that of under arm-plate near base of arm, inside scale, .8 : 1.2 ; outside scale a trifle shorter. Color, in alcohol : disk, above, brownish gray (burnt umber and neutral tint), with fine specks of umber brown, each radial shield bounded by a line of umber brown ; below, interbrachial spaces light brownish-gray, with a few specks of light umber-brown ; mouth-shields and angles of mouth light umber-brown ; mouth-papillæ white ; under and side arm-plates like interbrachial spaces below, but variously clouded, and marked with white and with shades of brown ; arm-spines white, with a brown line round the base ; upper arm-plates same as upper side of disk, but variously lined and marked with dark-brown ; the breaks in the plates are marked with this color.

Variations.—This species is always sober in its colors, the chief variation being in intensity ; old specimens are sometimes nearly black, while others are dark gray, speckled with umber brown. The young might well be mistaken for another species. A specimen with a disk of 9.5^{mm} had arms 32^{mm}. Upper arm-plates regular and unbroken, covering only a part of upper surface of arm, their inner side much shorter than the outer ; seven arm-spines ; sixteen to eighteen mouth-papillæ ; radial shields large, oval, length 1.5^{mm}. Color, above, very light brown,

with specks of umber brown on disk, and bands of the same on arms; below, nearly white. The upper arm-plates are usually not broken until the animal has a disk at least 12^{mm}.

This species differs from others with radial shields and unequal spines, as follows: from *O. rubicunda*, in position and shape of mouth-shields; from *O. panamensis*, in having broken upper arm-plates, and in shape of mouth-shields; from *O. squamosissima*, in having upper arm-plates broken, instead of scaly.

A comparison of the original of Müller & Troschel in the Vienna Museum shows that their specimen is a young one of this species. Dr. Lütken's name *Antillarum* must therefore be dropped.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number, of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
72	..	5	Tortugas, Fla.	Mh. 15-20, '58.	J. E. Mills.	Alcoholic.
73	..	1	Tortugas, Fla.	Early Mh. '58.	J. E. Mills.	"
74	..	1	Tortugas, Fla.	Feb. 1856.	Theo. Lyman.	"
75	..	1	Florida.	.....	Prof. Agassiz.	"
76	..	2	Florida.	.....	Prof. Agassiz.	"
77	..	1	Hayti.	.....	Dr. D. F. Weinland.	"
78	..	6	St. Thomas, W. I.	.....	A. H. Riise.	"
79	..	1	Florida.	.....	J. E. Mills.	"
80	..	3	Cape Florida.	.....	G. Wurdeman.	"
81	48	1	West Indies.	.....	Univ. Mus. Cop'hagen.	"
82	..	3	Jeremie; Hayti.	.....	Dr. D. F. Weinland.	"
83	..	1	Florida.	.....	Prof. Agassiz.	Dried.
84	..	1	.....	.....	.....	"
85	..	2	Florida.	.....	G. Wurdeman.	"
86	..	2	Gulf of Mexico, south of Vera Cruz.	.....	S. S. Haldeman.	"
413	Hayti.	.....	Dr. D. F. Weinland.	Alcoholic.
<i>Smithsonian Institution.</i>						
1046	..	3	Tortugas, Fla.	.....	Capt. Woodbury.	Alcoholic.
994	..	1	Garden Key, Tortugas.	.....	G. Wurdeman.	"
1013	..	1	Key Biscayne, Fla.	.....	G. Wurdeman.	"
1061	..	1	Aspinwall.	.....	Rev. T. Powell.	"
1072	..	3	St. Thomas, W. I.	.....	A. H. Riise.	Dried.
1073	..	1	St. Thomas, W. I.	.....	A. H. Riise.	Alcoholic.
1106	..	2	St. Thomas, W. I.	.....	A. H. Riise.	"
1178	..	1	Florida.	.....	.....	"
1153	..	4	St. Thomas, W. I.	.....	A. H. Riise.	"

Ophiura rubicunda LYMAN.*Ophioderma rubicunda* LÜTKEN. Vidensk. Meddelelser. Jan., 1856.*Ophioderma rubicunda* LÜTKEN. Addit. ad Hist. Oph., p. 90.

Special Marks. — Color, above, variegated lake-red; mouth-shields much rounded; second mouth-papilla very broad; side mouth-shields naked.

Description of a Specimen. — Diameter of disk, 17.5^{mm} ; from outer side of mouth-shield to outer corner of opposite mouth-slit, 6.8^{mm} ; width of arm, without spines, 3.5^{mm} ; length of arm, 103^{mm} ; distance from outer side of mouth-shield to inner points of teeth, to that between outer corners of mouth-slits, 3.5:3.6. Mouth-papillæ, fourteen to sixteen; three outer ones broader than the rest; second one, in particular, very flat and broad, often as wide as $.7^{mm}$; other mouth-papillæ flattened spiniform; two innermost ones somewhat broader, and shaped like short spear heads. Teeth five, short, flat, stout, with rounded edges, rather broader than long, except uppermost one, which is longer and more tapering. Mouth-shields crowded close against mouth-papillæ, much rounded, heart-shape, with point inward; length to breadth, 2:2. Side mouth-shields covered by grains, except a small round piece, which connects mouth-shield with outer mouth-papilla and innermost under arm-plate. Under arm-plates overlapping, rather broader than long, bounded without by a clean curve, on the sides, by re-entering curves (where tentacle-scales come), and within by two short, slightly-sloping, inner laterals, and an inner side, which is a little re-enteringly curved; length to breadth (twelfth plate), 1.2:1.5. First plate diamond oval, length to breadth, .7:1.3; second plate, length to breadth, 1.2:1.2; the plates then grow proportionately wider to the seventh, which has the length to breadth, 1.1:1.6; the proportions of twelfth plate are typical, and are continued till close to tip of arm. Side arm-plates intruding a little between upper arm-plates, but not meeting above and below till very tip of arm. Upper arm-plates much broader than long, covering upper surface of arm completely, so that side arm-plates are scarcely to be seen; outer and inner sides sensibly straight, the latter rather shorter, so that lateral sides slope a little; outer corners rounded, length to breadth, 1:3; about two thirds out on arm same general shape, but longer, length to breadth, .8:1.8; first three plates enclosed by scaly prolongations of disk, and consequently more or less rudimentary, especially first plate, which almost disappears. Granulation of disk close, fine, regular, covering every part, except radial shields, part of side mouth-shields, and fine scales at base of arms, and extending quite to base of mouth-papillæ; about 144 grains to a square *mm*. Radial shields

small, oval, length 1^{mm}.; there are sometimes, near base of arms, above, one or two little naked rounded plates. Arm-spines eight or nine, lowest one much longest and largest; flattened, slightly tapering, rounded at end; rest of spines more flattened, short, and tapering, increasing gradually in length from above downward; lengths to that of lower arm-plate: first spine, .9 : 1.2; second spine, .8 : 1.2; fifth spine, .6 : 1.2; ninth spine, .5 : 1.2. About two thirds out on arm, only six spines, which are sharp and rounded. Tentacle-scales, inside one clean oval, rather thin; length to that of under arm-plate, .7 : 1.2; outside one shorter, rather broader, cut square off at the end. Color, in alcohol: above, disk uniform dull pink-red (lake and Indian red), arms finely and irregularly mottled and banded with lighter and darker shades of the same; below, uniform in color, which is the same as that above, but much lighter; arms somewhat lighter than interbrachial spaces.

Variations. — Another specimen was somewhat darker than the above, had the disk finely mottled, and the arms mottled, red and light yellowish. The arms are usually, in well-grown specimens, about five times the diameter of the disk. There is a so-called variety of this species, which may be said to have the under side of *O. cinerea*, and the upper side of *O. rubicunda*. The mouth-shields are as in *O. cinerea*, and the mouth-papillæ, though finer and more irregular, are also somewhat alike; the mouth-shields are surrounded by granulation, which completely covers the side mouth-shields. The specimen I examined had a disk of 20^{mm}, while the length of the arms was only four times as great. It is manifestly not philosophical to suppose, as Dr. Lütken does, that this form is a *hybrid* between *O. rubicunda* and *O. cinerea*. No hybrids occur between the other closely allied West Indian Ophiurans. Among many hundred specimens of *Ophiocoma crassispina* and *O. Riisei* that I have examined, I never saw one that even looked like a hybrid; and the same is true of other species. This form is certainly a curious one; and it seems not improbable that it may prove a new species.

O. rubicunda is distinguished from *O. cinerea* by smaller radial-shields and whole upper arm-plates, and, by the latter character, from *O. squamosissima*; from *O. panamensis*, by larger mouth-shields, naked side mouth-shields, outer mouth-papillæ broader, &c.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
104	..	6	St. Thomas, W. I.	.....	A. H. Riise.	Alcoholic.
105	50	1	West Indies.	.....	Univ.Mus.Cop'hagen.	"
106	..	2	Cape Florida.	.....	G. Wurdeman.	Dried.
<i>Smithsonian Institution.</i>						
1074	..	1	St. Thomas, W. I.	.....	A. H. Riise.	Dried.
1105	..	2	St. Thomas, W. I.	.....	A. H. Riise.	Alcoholic.
1152	..	3	St. Thomas, W. I.	.....	A. H. Riise.	Dried.

Ophiura panamensis LYMAN.

Ophioderma panamensis LÜTKEN; Addit. ad Hist. Oph., p. 91.

Special Marks. — Color, in alcohol, above, greenish gray, with a central light mark; arms the same, alternating with lighter and darker bands; mouth-shields a good deal rounded; arm-spines stout, blunt, little tapering; side mouth-shields granulated.

Description of a Specimen. — Diameter of disk, 25^{mm.}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 8.5^{mm.}; width of arm without spines, 5^{mm.}; length of arm, 102^{mm.}; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 4.3 : 4.6. Mouth-papillæ, nineteen or twenty to each angle of mouth; outermost one long and spine-like, reaching above its next neighbors; the next one, or two, flat and squarish; the rest fine and spiniform, except the innermost, which is much larger and stouter. Teeth five, upper and under ones flat and pointed; the others flat, squarish, with a curved cutting edge; they are unusually short. Mouth-shields broader than long, irregular oval, with a rounded angle within; length to breadth, 2.2 : 3. Under arm-plates octagonal, with rounded corners; about as broad as long; a little overlapping; length to breadth (twelfth plate), 1.4 : 1.5. Upper arm-plates much broader than long, overlapping; outer side nearly straight, with a slight re-entering curve in the middle; lateral sides well rounded; length to breadth (ninth plate), 1.4 : 4; three or four plates inclosed by the incisions in the disk. Disk, above and below, finely and closely granulated, except on radial-shields, and some narrow lines of scales at base of arm, which run under the disk as far as the inner end of the outer genital slit; about 120 grains to a square *mm.* Radial shields oval; length to

breadth, 1.5 : 1.3. Arm-spines ten, rounded, little tapering, little flattened, decidedly stout ; of nearly equal length, except the two lowest ; lengths of uppermost and of the lowest to that of under arm-plate (thirteenth joint), .8, 1.1 : 1.4. Near the tip of the arm, the spines are six in number, and more rounded and slender. Tentacle-scales large ; inside one long, regular oval ; outside one unusually broad. Color, in alcohol : above, greenish gray, with a white mark in the centre ; arms banded with lighter and darker greenish-gray ; under surface uniform light greenish-gray.

Variations. — The color varies in intensity, sometimes being clouded with brownish, and again tending to light greenish ; the central white spot, though common, is not always found. The young of this species have no *radial shields* ; one, with a disk of 7^{mm}, was just beginning to show them ; while another, with a disk of 11^{mm}, was still entirely granulated. This case is just reversed in *O. teres*. A specimen with a disk of 6.5^{mm} had already eighteen mouth-papillæ, but only seven arm-spines. The proportions of the disk to the arms were as follows, in different specimens : 26 : 96, 21 : 70, 20 : 75, 14 : 46, 13 : 52, 9.5 : 40, 6.5 : 23 ; so that the disk is usually contained in the arms from three and a half to four times.

This species differs from others with unequal arm-spines and with radial shields, as follows : from *O. cinerea* and *O. squamosissima*, in having the upper arm-plates undivided ; from *O. rubicunda*, in the different shape and position of the mouth-shields.

I am not quite sure that this is the true *Ophioderma panamensis* Ltk. Dr. Lütken got his specimen from the Smithsonian Institution. There are now at the Smithsonian Institution and at the Museum of Comparative Zoölogy many specimens of the *Ophiura* here described ; *besides* which there is a single specimen (1181 Smithson. Instit.) which may be the same species, or a variety ; the arm-spines are sharper, a little, and there are dark, longitudinal lines on the outer edges of the upper arm-plates. *Neither* of these agrees perfectly with Lütken's description ; the differences consisting in slight variations in the spines, and in the markings of the upper arm-plates ; still, they are all probably the same, and are therefore here included under *O. panamensis*.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
108	..	5	Acapulco.	.....	Alex. Agassiz.	Alcoholic.
109	..	2	Panama.	.....	Alex. Agassiz.	"
110	1188	2	Cape St. Lucas, Cal.	.....	J. Xantus.	"
<i>Smithsonian Institution.</i>						
? 1181	..	1	Pan	.....	Rev. T. Powell.	Alcoholic.
1055	..	1	Panama.	.....	Mr. Sternberg.	"
1069	..	8	Cape St. Lucas, Cal.	.....	J. Xantus.	"
1188	..	9	Cape St. Lucas, Cal.	.....	J. Xantus.	"

Ophiura appressa SAY.

Ophiura appressa SAY. Journ. Phil. Acad., V. p. 151. 1825.

Ophioderma virescens LÜTKEN. Addit. ad Hist. Oph., p. 92.

Special Marks. — Color grayish, or variously marbled dark green and yellowish; arm-spines nine, rather short, flattened; arms stout; mouth-shields broad heart-shaped.

Description of an Individual. — Diameter of disk, 16^{mm}; from outer edge of mouth-shield to outer corner of opposite mouth-slit, 5.2^{mm}; width of arm without spines, 2.7^{mm}; length of arm, 62^{mm}; distance from outer edge of mouth-shield to inner points of teeth, to that between outer corners of mouth-slits, 2.7:2.7. Mouth-papillæ, eighteen to twenty to each angle of jaw, strongly flattened, longer than broad, edges rounded; second, third, and fourth (from without), and also two innermost ones, broader than the others; outermost one of all rounded, sharp, tapering. Teeth five, broad, stout, somewhat pointed; uppermost one narrow and sharp; uppermost and lowest smaller than other three. Mouth-shields very broad, rounded, heart-shape, length to breadth, 1.3:2; outer side usually straight, or slightly re-entering; corners cleanly rounded. Side mouth-shields entirely covered, except a small rounded piece, connecting mouth-shield with innermost arm-plate. Under arm-plates a little overlapping, longer than broad;* in front rounded; sides re-enteringly curved, where tentacle-scales encroach; inner laterals very short, and sloping towards middle of arm; inner side straight; length to breadth, twelfth plate, 1:8. First plate oval diamond-shape; length to breadth, .7:1. Second plate like those beyond, but rather shorter and wider;

* The form of the arm-plates applies to the portion that can be seen without preparation; some parts are hidden by the tentacle-scales and the neighboring plates.

length to breadth, .9 : 1. The plates maintain the same shape till near the point of the arm, where the inner lateral sides begin to grow proportionately longer, and at the very tip the shape becomes almost triangular. Side arm-plates very evenly curved, on their outer side encroaching a little on upper arm-plates, so that their upper edges can be well seen from above. Upper arm-plates broader than long, bounded without and within by nearly straight lines (outer side sometimes a little re-enteringly curved), sides well rounded, overlapped on their inner portion by side arm-plates. First plate small, and partly covered by fine scales which are at the base of the arm; length to breadth, .6 : 1.8; twelfth plate, length to breadth, 1 : 2.2. About two thirds out on arm, the plates begin to be more overlapped by the side arm-plates, which makes the lateral sides more sloping, and inner side shorter, so that, in the last three or four joints, the plates are triangular, the side arm-plates meeting above. Inner pair of genital slits granulated; outer pair granulated on one side, and scaly on the other. Arm-spines commonly nine, short, flattened, tapering only near the point, which is rounded; of nearly equal length, except lowest one, which is decidedly longer, and does not taper at all; lengths to that of lower arm-plate (twelfth joint), lowest spine, .9 : 1; second, .7 : 1; third, .6 : 1; eighth .5 : 1; second, third, and fourth joints, three spines; two uppermost much thinner; fifth and sixth, five spines; seventh and eighth, seven spines; ninth, eight spines; two thirds out on arm there are six spines, and at the very tip, only four. Granulation of disk very close, smooth, and even, covering every part, except a few scales at base of arms, and extending below quite to the mouth-papillæ; grains remarkably round and smooth, about 110 to a square *mm*. Two tentacle-scales; inside one longer, oblong, with rounded corners, length, .7^{mm}; outside one about two thirds as long, somewhat broader, and cut off square at the end. Color, in alcohol: above, ground color yellowish white, with irregular stripes and patches of greenish black on disk, and belts of the same on arms; the edges of the dark arm-plates are, however, speckled with lighter; below, interbrachial spaces dirty olive, with two large spots of whitish in each; chewing apparatus dirty white, ground color of arms the same, marked and banded with different shades of brownish olive.

Variations. — It is hard to find two specimens colored alike. There are two chief varieties, the gray, which was that described originally by Say, and the variegated green. The gray is more uniform, having usually the disk greenish gray, with fine points of darker and lighter, and the arms irregularly banded with darker, the lower parts being similar, but lighter. The green variety may be marbled, spotted, and lined with every possible pattern of green and whitish or yellowish; sometimes a specimen may be seen almost pure white. The gray va-

riety seems more abundant near St. Thomas, and the green, at Cape Florida. The length of the arms is four or five times the diameter of the disk, and the proportion is about the same in those of moderate size and in the largest. The side mouth-shields may be entirely covered by grains.

This species comes among those that have the lowest arm-spine longest, and have no radial shields. It differs from *O. Elaps* in the number and form of the arm-spines.

LIST OF SPECIMENS.

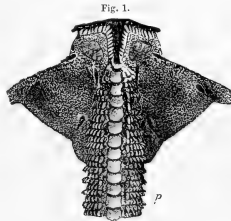
Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
57	..	12+	Florida.	.....	G. Wurdeman.	Alcoholic.
58	..	8	Florida.	.....	Prof. Agassiz.	"
59	53	4	West Indies.	.....	University Museum, Copenhagen.	"
60	..	10	Tortugas, Fla.	Mar. 15, '58.	J. E. Mills.	"
61	..	2	Tortugas, Fla.	July, 1859.	Capt. Woodbury.	"
62	..	4	Tortugas, Fla.	Ap. 21, 22, '58.	J. E. Mills.	"
63	..	3	Bay of Cumana.	.....	Capt. Couthouy.	"
64	..	4	Cape Florida.	Apr. 18, '58.	G. Wurdeman.	"
65	..	1	Jeremie; Hayti.	.....	Dr. D. F. Weinland.	"
66	..	7	St. Thomas, W. I.	.....	A. H. Riise.	"
67	..	5	Cape Florida.	Apr. 1858.	G. Wurdeman and J. E. Mills.	"
68	..	1	Charleston, S. C.	.....	Prof. F. S. Holmes.	Dried.
69	..	12+	Florida.	.....	G. Wurdeman.	"
70	..	12+	Florida?	.....	.....	"
71	..	3	Florida.	.....	Prof. Agassiz.	"
412	Key West.	.....	.....	Alcoholic.
<i>Smithsonian Institution.</i>						
986	..	4	Cape Florida.	.....	G. Wurdeman.	Alcoholic.
981	..	2	Garden Key, Tortugas.	.....	G. Wurdeman.	"
1071	..	5	St. Thomas, W. I.	.....	A. H. Riise.	"
1082	..	1	St. Thomas, W. I.	.....	A. H. Riise.	Dried.
1104	..	4	St. Thomas, W. I.	.....	A. H. Riise.	Alcoholic.
1179	..	12+	Florida.	.....	.....	"
1180	..	1	Tortugas, Fla.	.....	Capt. Woodbury.	"
1154	..	4	St. Thomas, W. I.	.....	A. H. Riise.	Dried.
1192	..	2	Cape Florida.	.....	G. Wurdeman.	Alcoholic.

Ophiura teres LYMAN. (Fig. 1.)

Ophiura teres LYMAN. Proceed. Boston Soc. Nat. Hist., VII p. 198. 1860.

Special Marks. — A very large species. Upper arm-plates broken; arms short, rounded.

Description of a Specimen. — Diameter of disk, 32^{mm.}; outer edge of mouth-shield to outer corner of opposite mouth-slit, 12^{mm.}; width of arm, without spines, 7^{mm.}; length of arm, 133^{mm.}; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 5:5.6. Mouth-papillæ, about eighteen to each angle of mouth, small, tooth-like, somewhat crowded; the innermost, and outermost but one, on each side, broader and larger than their neighbors. Teeth six, broad, flat, short, with the free edge curved, the upper ones more pointed. Mouth-shields very broad heart-shape, usually presenting three rounded lobes, of which one is directed inward; length to breadth, 2.5:3.5. Side mouth-shields covered by granulation of disk. Under arm-plates small, squarish, bounded without by three sides, with much rounded angles, and within by a slightly curved line; length to breadth (thirteenth plate), 1.5:2. The first five plates are smaller and narrower; and between the first and second, second and third, and third and fourth, there is a pair of pores. Upper arm-plates very short and wide; length to breadth, 1.7:6.5. All the plates, except those just at the tip of the arm, are broken in irregular pieces; those near base of arm usually in five; those near its tip, in three or four; so that the upper surface seems covered with an irregular mosaic. Granulation of disk fine and even, about 56 grains to a square mm., covering radial shields and the whole disk, above and below; near base of arms, above, are sometimes one or two little naked plates of variable size. Arm-spines short, flat, tapering, rather stout, nine in number; three lowest ones rather longer than the rest, and lowest one longest of all; upper ones about half as long as side arm-plates. Length of uppermost spine, .5^{m.}; of lowest one, 1.2^{m.}. There are often as many as eleven spines on joints near disk. Tentacle-scales longer than broad, flattened; outside one rather shorter, and cut off more square at the end. Color, in alcohol: above, purplish brown, with upper arm-plates closely speckled with lighter; below, chewing appa-



Ophiura teres. (Lower side.)
p, arm-spines.

ratus, lowest arm-spines, and under arm-plates, yellowish white; the rest purplish brown.

Variations. — The mouth-shields may differ somewhat in shape, and the under arm-plates may be light brown. The radial shields are almost always *present*, except in very large specimens. A small specimen had a disk of 14^{mm}, and arms of 35^{mm}; there were seven or eight arm-spines; most of the upper arm-plates were broken in only two pieces; the color was very dark umber, with fine, sinuous black lines on the disk.

This species at once strikes the eye by its short, rounded arms, covered above by a multitude of irregular pieces. It is distinguished from *O. panamensis*, by broken arm-plates, and proportionately shorter arms; from *O. variegata*, by proportionately shorter arms, granulated side mouth-shields, &c. It most resembles the dark variety of *O. cinerea* (*O. Antillarum* Ltk.) of the West Indies, but differs in having shorter and more rounded arms.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
87	..	2	Panama.	.....	Alex. Agassiz.	Alcoholic.
88	..	1	Acapulco.	.....	Alex. Agassiz.	"
<i>Smithsonian Institution.</i>						
1051	..	3	Panama.	.....	Rev. T. Powell.	Alcoholic.
1184	..	1	Panama.	.....	Dr. Sternbergh.	"
1168	..	1	Cape St. Lucas, Cal.	.....	J. Xantus.	"

OPHIOPEZA PETERS.

Ophiopeza fallax PETERS. Wiegmann's Archiv. 1852, p. 82.

It is a little singular that alcoholic specimens of this genus were brought home by Quoy and Gaimard as early as 1829, but were passed over for twenty-three years, when Dr. Peters described the genus from specimens collected by himself.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
423	Jardin des Plantes, Quoy & Gai., 1829.	Alcoholic.
405	Zanzibar.	.....	C. Cooke.	"
406	Zanzibar.	.....	Capt. Webb.	"
407	Zanzibar.	.....	E. Ropes.	"

OPHIARACHNA MÜLL. & TROSCH.

Ophiarachna gorgonia MÜLL. & TROSCH. Syst. Asterid., p. 105.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
395	Zanzibar.	.....	E. Ropes.	Alcoholic.
396	Zanzibar.	.....	Capt. Webb.	"
397	Zanzibar.	.....	C. Cooke.	"

OPHIOGLYPHA* LYMAN.

TYPE OF THE GENUS, *O. lacertosa*.*Ophiura* FORBES (non Lamk.).

Disk covered with unequal, crowded, naked, more or less distorted scales, some of which are swollen. Radial shields naked and swollen. Teeth. No tooth-papillæ. Mouth-papillæ long within, but small and short near the outer end of the mouth-slit, and partly hidden by the scales of the mouth-tentacles. Arm-spines few (commonly three), arranged along the outer edge of the side arm-plates. Tentacle-scales numerous; the innermost pair of tentacle-pores shaped like slits, surrounded by numerous tentacle-scales, and opening diagonally into the mouth-slits. Side arm-plates meeting nearly, or quite, below, but not above. In the back of the disk, where the arm joins it, a notch edged with papillæ. Two genital slits, starting from the sides of the mouth-shields.

GROUPING OF SPECIES HEREIN DESCRIBED.

- | | | |
|--|---|-----------------------|
| Arms smooth, tapering, pretty long; three arm-spines; mouth-shields shield-shaped, large, | { | <i>O. lacertosa</i> . |
| <i>O. Sarsii</i> . | | |
| <i>O. robusta</i> . | | |
| <i>O. Lütkenii</i> . | | |
| Arms slender, smooth; arm-spines short, | | <i>O. albida</i> . |
| Arms very short, thick, knotted; arm-spines rudimentary, resembling tentacle-scales; mouth-shields very long and narrow, | { | <i>O. nodosa</i> . |
| | | <i>O. Stuwitzii</i> . |
| Arms slender; disk-scales mostly small, with a few large ones regularly placed in the centre, | { | <i>O. affinis</i> . |

Ophioglypha lacertosa LYMAN.*Stella lacertosa* LINCK. De Stel. Mar., pl. II. fig. 4, p. 47. 1733.*Ophiura texturata*? LAMK. Hist. Anim. s. Vert., II. p. 542. 1816.*Ophiura texturata* FORBES. Brit. Starfishes, p. 22. 1841.*Ophiura texturata* LÜTKEN. Addit. ad Hist. Oph., p. 36.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
56	..	1	Oresund.	.....	University Museum, Copenhagen.	Alcoholic.
435	Mediterranean.	.....	Jardin des Plantes.	"
393	Conway Bay.	.....	.....	"

* ὄφις, snake; γλυνφύη, notch.

Ophioglypha Sarsii LYMAN. (Figs. 2, 3.)

- Ophiura acutera* AGASS. Proceed. Am. Acad., 1851, p. 269. [No description.]
Ophirolepis ciliata STIMPS. Inverteb. of Grand Manan. Smithsonian. Contrib., VI. p. 13. 1854.
Ophiura coriacea LÜTKEN. Vidensk. Meddelelser. Nov., 1854.
Ophiura arctica? LÜTKEN. Vidensk. Meddelelser. Nov., 1854.
Ophiura Sarsii LÜTKEN. Vidensk. Meddelelser. Nov., 1854.
Ophiura Sarsii LÜTKEN. Addit. ad Hist. Oph., p. 42.

Special Marks. — Arms, in the adult, three or four times as long as diameter of disk; longest arm-spine about as long as an arm-joint; primary plates much larger than the intermediate disk-scales.

Description of a Specimen. — Diameter of disk, 17.8^{mm}.; from outer edge of mouth-shield to outer corner of opposite mouth-slit, 8^{mm}.; width of arm, without spines, 3.5^{mm}.; length of arm, 60^{mm}.; distance from outer edge of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 4.6 : 3.4. Mouth-papillæ usually thirteen to each angle of mouth, namely, six on each side, and one at apex of angle; sometimes seven on each side, or again only five; the papilla at the apex points directly to centre of mouth, and is about twice as large as any of the others; it has a diamond or spear-head shape; rest of papillæ small, flat, short, and rather sharp; outer ones smallest; outermost one usually broader and lower than others, being shaped like a cutting edge. Teeth shaped like innermost mouth-papilla, usually four, but sometimes five in number. Mouth-shields longer than broad, bounded by a curve without, an angle within, and laterally by straight lines; length to breadth, 2.4 : 2; length of sides bounding inner angle, 1.4^{mm}.; madreporic shield rather smaller and more rounded, with a slight rising in the middle. Side mouth-shields curved, and very long and narrow; starting from inner end of mouth-slits, they follow the sides of the mouth-shield, and meet at its inner point; length to breadth, 2.4 : .6. Under arm-plates covered in good part, even at base of arm, by side arm-plates; all of them, therefore, are much broader than long, and are bounded only by three sides, viz., one outer side nearly straight, and two inner laterals, which are a little re-enteringly curved, and which slope from outer corners of plate towards its middle line, on which they meet in a point; the shape is that of a very short triangle, the point being directed inward. First plate unusually large, nearly oval, length to breadth, 1 : 2; second plate of usual shape, but a little longer than those immediately following, length to breadth, 1 : 2; length of inner lateral, 1.4^{mm}.; twentieth plate, .6 : 1.2; plates about two thirds out on arm, .4 : .8; close to tip of arm, plates so covered as to be scarcely perceptible; they are not more than one half or one third the width of the arm, and are bounded by six sides, two outer laterals and two inner laterals, sloping towards

middle line of arm, and meeting to form the outer and inner points of the plate; and two short laterals. Side arm-plates have a large proportionate size to that of other plates; where they meet below, the line of juncture is straight, and this line grows longer as the plates encroach more and more; thus its length, to that of corresponding under arm-plate, is as follows: first joint, $.4:1$; twentieth joint, $.8:.6$; about two thirds out on arm, $.8:.4$; the upper side of each side arm-plate runs outwards and downwards in a curved line, and overlaps the corresponding upper arm-plate; the outer side runs almost straight downwards to the tentacle-scales, where it makes a little point, and then bends inwards to meet its corresponding plate on the middle line of the arm; the side arm-plates do not meet above till very near the end of the arm. Upper arm-plates, at base of arm, longer than broad, outer side slightly curved, and longer than inner side, so that the lateral sides are sloping; farther out the plates grow proportionately longer, and their outer sides more curved; plates near tip of arm long heart-shaped, the point inward; nearly four plates are included in the incision of the disk; first plate small, triangular, thickened, its point being directed inward, length to breadth, $.8:.8$; second plate also small, four-sided, outer side longer, length to breadth, $.8:1$; third plate proportionately wider than second, length to breadth, $.8:1.4$; fourth plate, $.8:2.2$; fifth plate, $1:3$; sixth plate, $1:2.8$; length of inner side, 2^{mm} ; about two thirds out on arm, $1.2:1$; close to tip of arm, $.6:.4$. Disk, above: radial shields large, bounded, and more or less overlapped, along their edges, by surrounding scales; the outer half of their inside edge is free, and bounds the inner portion of the incision in the disk, its outer portion being bounded by radial scales; length to breadth, $3.2:2.2$; in centre of disk six large, rounded, nearly equal primary plates, central one nearly round, others somewhat oval, their edges overlapped by finer scales about them; diameter of centre plate, 1.6^{mm} ; in inter-brachial spaces, between central primary plates and edge of disk, three other primary plates, lying in a line at about equal distances; inner one rounded, middle one long oval, outer one, lying on the very edge of disk, rounded; in brachial spaces, one rounded primary plate, lying close to inner ends of radial shields; space between radial shields filled by a very small scale, lying outside, followed by a large scale, and this by two or three very small scales irregularly disposed; rest of disk, above, covered by numerous irregular scales, some as large as primary plates, but most of them varying in length from $.4^{\text{mm}}$ to 1^{mm} ; disk, below, covered closely with more regular and even scales than those above; near the mouth-shields, in particular, they are of even size, and are regularly imbricated, having an average length of about $.8^{\text{mm}}$. Genital slits edged

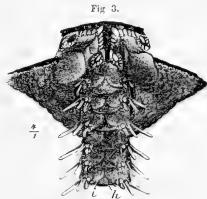
Fig. 2.



Ophioglyphus Sarsii.

Upper side, showing the comb of papillae at the base of the arm. J, upper arm-plate.

with very fine, flattened, close-set papillæ, which grow suddenly much larger as they pass upwards along edge of radial scale; whole number about forty; longest ones on radial scales having a length of .6mm. Papillæ running along sides of basal upper arm-plates very small; they start at the inner side of second plate, and run to outer side of fourth plate, there being about four papillæ to each plate; outermost papillæ largest. Arm-spines smooth, rounded, tapering, sharp; second joint, two spines, lengths to that of under arm-plate, .4, .8:1; third joint, three spines, .4, .8, 1.2:1; all the rest of the joints have exactly three spines, except close to tip of arm; fifth joint, 1.6, 1.6, 1.2:1; about two thirds out on arm, 1, 1, 1:4; close to tip of arm, middle spine longest, and equal to a little over half the length of the joint; other two spines about equal. Tentacle-scales at base of arm flat and square, and rounded at the corners; in shape much like some of the side mouth-papillæ; mouth tentacles surrounded by a crown of scales, arranged close together in an oval, usually nine on the side next the mouth-shields, and five on the other side; sometimes, however, seven on one side and six on the other; second joint, six scales, three without, and three within the tentacle; third joint, four scales, two without and two within; fourth joint and those just beyond, three scales, two within the tentacle, and one lying between it and middle line of arm; farther out, the last mentioned scale and the one next to it grow smaller and smaller, and finally disappear about three fifths out on the arm, while the third scale maintains its size, and is found quite to the tip of the arm, where it becomes pointed and spear-like. Color, in alcohol: uniform dirty white, or very faint brown; disk above, and chewing apparatus below, a shade darker; color, when dry, chalky white.



Ophioglypta Sarsii. (Lower side.)
a, lower arm-plate; i, lower part of side arm-plate.

Variations. — A young one has the following characters: diameter of disk, 3.7mm.; length of arms, 9mm. Mouth-papillæ, three on each side, and one at the inner apex of the mouth angle; outer one broadest. First under arm-plate largest of all; plates immediately beyond it small, their length being less than that of the line of juncture of the side arm-plates below. Side arm-plates not meeting above till half way out on the arm. Upper arm-plates proportionately longer than in the adult; two of them are included by the notch in the disk. Arm-spines three; two upper ones nearly as long as arm-joints; lowest one much shorter. There are eleven papillæ, in a close row, along the radial scales and genital slits. The mouth-tentacles have two scales on the side next the

mouth-shield, and one on the other side; the rest of the pores have but one scale. Upper side of the disk almost completely covered by primary plates and radial shields, which are rounded and much swollen; of the primary plates, there is a rosette of six in the centre, and three in each interbrachial space. A larger specimen had a disk of 7^{mm}, and arms 24^{mm}; and another had the disk 10.5^{mm}, arms 42^{mm}. The mouth-shields vary somewhat in proportionate length; those of the young have a deeper depression where they touch the inner end of the genital slit. The adult have the disk-scales flatter, and the primary plates and radial shields more conspicuous, by reason of the many small scales between them. Dr. Lütken mentions a variety (*O. coriacea* Ltk.) which has only one tentacle-scale, and the disk-scales very small; and another (perhaps a variety) which has no papillæ on the incision of the disk, arm-spines only half as long as in *O. Sarsii*, and a hairy or felted covering over the surface (*O. arctica* Ltk.). The color of the living animal is a mixture of green, yellow, and gray, with sometimes light bands on the arm (Barrett).

O. Sarsii has been found in Massachusetts Bay, and at the Grand Manan (Stimpson); along the whole coast of Greenland (Holböll, Barrett, &c.); at Spitzbergen, and on the coast of Norway (Sars). It is distinguished from *O. robusta* by the different scaling of the disk; from *O. texturata*, by wanting pores on the under side of the inner arm-joints; from *O. carnea* and *O. albida* by longer arm-spines; and from *O. Lütkenii*, by the double row of notch papillæ, and by their greater sharpness.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
33	..	12	Grand Manan Island, and Eastport, Me.	.....	Prof. Agassiz.	Alcoholic.
34	..	2	Eastport, Me.	.....	J. E. Mills.	"
35	41	4	Greenland.	.....	University Museum, Copenhagen.	"
36	..	1	Greenland.	.....	Prof. Sars, 1852.	"
37	..	2	Trenton, Me.	.....	A. E. Verrill.	"
38	..	6	Massachusetts Bay.	.....	.....	Dried.
39	..	2	.....	.....	.....	"
<i>Smithsonian Institution.</i>						
1022	..	1	Greenland.	.....	University Museum, Copenhagen.	Alcoholic.
1025	..	1	Greenland.	.....	University Museum, Copenhagen.	"
1023	..	1	Grand Manan Island.	.....	Wm. Stimpson.	"
1040	..	12+	Massachusetts Bay.	.....	Wm. Stimpson.	"
1095	..	1	Coast of Me. and Mass.	.....	Wm. Stimpson.	"

Ophioglypha robusta LYMAN.

Ophiolepis robusta AYRES. Proceed. Boston Soc. Nat. Hist., IV, p. 134. 1851.

Ophiura fusciculata FORBES. Appendix to Sutherland's Journal of a Journey.

Ophiura squamosa LÜTKEN. Vidensk. Meddelelser. Nov., 1854.

Ophiura squamosa LÜTKEN. Addit. ad Hist. Oph., p. 46.

Special Marks. — Mouth-shields nearly heart-shape, broader than long; arms very finely tapering, as long as three or four times the diameter of the disk.

Description of a Specimen. — Diameter of disk, 7.7^{mm} ; from outer side of mouth-shield to outer corner of opposite mouth-slit, 3.8^{mm} ; width of arm without spines, 1.2^{mm} ; length of arm, 32^{mm} ; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 2 : 1.8. Mouth-papillæ, seven or eight to each angle of mouth; outermost one broadest, thin, flat, squarish, with a bevelled cutting edge; three innermost ones forming a row at the inner mouth-angle; nearly equal, stout, rounded, pointed; all pointing to centre of mouth. Teeth, five or six, equal, crowded, sharp, flat, with curved sides, like a spear-head. Mouth-shields broad heart-shape, strongly curved without, within pointed, broader than long, length to breadth, 1.2 : 1.5. Side mouth-shields occupying inner sides of mouth-shields, meeting within; long, narrow, but little broader without than within. Under arm-plates broader than long, bounded without by a slightly re-entering curve; on the lateral side, by a very short, nearly straight line; and within by two re-entering curves, converging in a peak; length to breadth (sixth plate), .5 : .7. First plate quite different from the others, being nearly oval; length to breadth, .5 : .8; second plate proportionately longer than those beyond; at tip of arm, plates heart-shape, and extremely minute, compared with size of joint. Side arm-plates strongly developed, meeting below, and there forming a line of juncture, which, at base of arm, is about half as long as an under arm-plate; not meeting above till nearly half-way out on arm. Upper arm-plates diamond-shape, with outer angle rounded, and inner angle truncated, sometimes approaching a hexagonal shape; length to breadth (fifth plate), .7 : .9; first two or three plates rudimentary and irregular, of these usually two are embraced in the notch of the disk; near end of arm, plate heart-shape, with a sharp point inward. Disk scales irregular in shape and size, none very large, very little swelled; primary plates not prominent; near margin of disk about 4 to a square mm. ; the largest scales have a diameter of $.8^{\text{mm}}$; below, scales very similar, but not quite so large. Radial shields inconspicuous, irregularly triangular, about as long as broad, somewhat overlapped by neighboring

scales; they barely touch without, being separated on the outside by the first upper arm-plate, and within by a large scale; length to breadth about 1 : .7. The row of papillæ along each side of the notch in the disk and the genital slit has about nineteen, of which seven or eight are stout, short, conical, and situated at base of arm; and about twelve are small and flat, and run along genital slit; besides these, there is a row, or irregular group, of from two to seven papillæ standing on each side of the upper arm-plate, just outside the papillæ of the notch. Arm-spines three, rounded, tapering, sharp, rather stout, upper one considerably the largest; lengths to that of under arm-plate (tenth joint), .8, .5, .4 : .5; at tip of arm, the lowest spine is flattened, and has one or two small hooks. Tentacle-scales small, thick, flattened, with a rounded end; those of the mouth-tentacles more rounded; mouth-tentacles with a row of four or five scales on the side next mouth-shields, and three or four on the other; second and third pores with two scales on the inner side, and one or two smaller ones on the outer; pores beyond, only one scale. Color, in alcohol, grayish white.

Variations.—A young one had the following character: diameter of disk, 3^{mm}; length of arm, 10^{mm}; first under arm-plate triangular, with rounded corners; other plates broad heart-shape, with a point inward. Upper arm-plates separated by side arm-plates; long heart-shape, with a point within, and a clean curve without. Arm-spines more slender than in the adult. In centre of disk an irregular rosette of primary plates. Only one or two papillæ along outer edges of radial shields, and none at all outside of them, on each side of the upper arm-plates. The proportions of the disk to the arms may be as follows: 3 : 10, 6.5 : 24, 6.5 : 25.5, 7.7 : 32, 8 : 30. Lütken also gives 10 : 30 and 7 : 21. It is very easy to get the arms too short, because they taper very finely, and, if the point is broken off, it is not easily detected; thus Dr. Ayres gives the length of the arm (in broken specimens) as but little greater than the diameter of the disk. Sometimes, in well-grown specimens, the basal under arm-plates often touch each other, and the upper arm-spine is proportionately more flattened; these two variations are said not to occur in European specimens. Large individuals have the under and upper arm-plates more angular. The mouth-shields differ in the proportional length, being sometimes regularly curved, or again having two short lateral sides, and an outer curve. The color, in alcohol, is often dark-greenish above, and ash-gray below. According to Dr. Lütken, the living animal is dark gray, reddish, or violet, above; often with greenish arms, barred with dark gray; the radial shields are almost always light, and the mouth-shields commonly have a violet spot.

O. robusta differs from the other species of the genus in its short, broad mouth-shields, and very finely tapering arms. I have examined

many specimens from Massachusetts Bay, Grand Manan Island, Greenland, and Denmark. It is also known from the Faroe Islands, the coast of Norway, Newfoundland, and even from the high latitude of Wellington Channel. It has been taken from low-water-mark (A. E. Verrill) to eighteen fathoms (Lütken). Forbes's remark, that the papillæ at the base of the arm are irregularly arranged, makes it next to certain that this species is his *O. fasciculata*.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
44	42 ^a	4	Greenland.	.....	University Museum, Copenhagen.	Alcoholic.
45	42 ^b	3	Greenland.	.....	University Museum, Copenhagen.	"
46	..	7	Phillips' Beach, Mass.	.....	Prof. Agassiz.	"
47	42 ^c	5	Oresund.	.....	University Museum, Copenhagen.	"
48	..	11	Greenland.	.....	Prof. Sars, 1852.	"
49	..	2	Grand Manan Island.	1860.	A. E. Verrill.	"
50	..	12+	Massachusetts Bay.	.....	Prof. Agassiz.	Dried.
51	..	2	Grand Manan.	.....	Wm. Stimpson.	Alcoholic
<i>Smithsonian Institution.</i>						
1035	..	2	Greenland.	.....	University Museum, Copenhagen.	Alcoholic.
1196	..	2	Coast of Me. and Mass.	.....	Wm. Stimpson.	"

Ophioglypha Lütkenii LYMAN.

Ophioglypha Lütkenii LYMAN. Proceed. Boston Soc. Nat. Hist., VII. p. 197.

Special Marks. — Mouth-papillæ very sharp; no papillæ on the arm outside those along the notch of the disk; papillæ along the notch of the disk flat, thick, blunt, crowded; arms strongly arched above.

Description of a Specimen. — Diameter of disk, 18^{mm.}; outer edge of mouth-shield to outer corner of opposite mouth-slit, 8.5^{mm.}; width of arm without spines, 3.5^{mm.}; length of arm, 90^{mm.}; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 4.8 : 3.9. Mouth-papillæ like thorns; a bunch of about ten at the point of the jaw, and two or three scattered ones on each side, placed above the scales of the innermost pair of tentacle-pores. Teeth about nine; long, narrow, flat, rather sharp, arranged sometimes in single, sometimes in double rows. Mouth-shields shield-

shaped, with an angle turned inward, and outer side rounded; lateral corners somewhat projecting; length to breadth, 3:3. Side mouth-shields straight, narrow, tapering, meeting within. Under arm-plates, at base of arm, broad, triangular, with lateral corners somewhat rounded; length to breadth, 1:2.5; farther out on arm, the plates, as is usual in the genus, grow smaller and smaller, from being encroached on by the side arm-plates. Upper arm-plates much broader than long, and having the outer and inner sides straight and parallel, and nearly equal; outer corners rounded; length to breadth near base of arm, 1.2:3.5. Scales of disk, above and below, not arched or swelled, but lying very flat and evenly; primary plates rounded, and conspicuous by their size. Radial shields broad, pentagonal, with outer angles rounded, and a sharp angle directed inward; completely separated by the innermost upper arm-plates; length to breadth, 2.8:2. Notches in disk, at base of arms, deep, admitting fully four arm-plates. Comb on the edges of each notch made up of thick, flat, spreading papillæ, crowded side by side, in a continuous line. These papillæ are only six or seven; they decrease in length as they pass under the disk, where they join the narrow, toothed edge that runs along the margin of each genital slit. On base of arm proper, no comb, or line of papillæ. Arm-spines three, tapering, sharp; upper one longest, and equal to about one and a half joints; lowest one shortest, and equal to a little less than one joint. Tentacle-scales of innermost pair of pores short, stout, crowded, flattened; usually four or five on the outer side, and four, somewhat smaller, on the inner side of each pore. Rest of tentacles with only one round and rather thick scale, but there may also be a little tooth, just outside the tentacle. Color, in alcohol: above, bluish gray (a sort of clay color), with darker markings; the arms the same, with darker bands; below, arms whitish; interbrachial spaces of a purplish hue, with white spots.

This species is nearest *O. Sarsii*, but differs in the want of a row of papillæ on the base of the arm, above; in having the papillæ of the arm-comb and of the inner pair of tentacle-pores more crowded and blunter; in the finer and sharper mouth-papillæ, &c.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Smithsonian Institution.</i>						
1039	. . .	1	Puget Sound.	. . . . .	Dr. Kennerly.	Alcoholic.

Ophioglypha albida LYMAN.

Ophiura texturata, 2 *eadem minor albida* (?) LAMK. Hist. Anim. s. Vert., II. p. 542. 1816.

Ophiura albida FORBES. Wern. Trans., VIII. p. 125.

Ophiura albida FORBES. Brit. Starfishes, p. 27.

Ophiura albida LÜTKEN. Addit. ad Hist. Oph., p. 39.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
52	39 ^a	3	Faroe Islands.	.....	University Museum, Copenhagen.	Alcoholic.
53	39 ^a	5	Kattegat and Oresund.	.....	University Museum, Copenhagen.	"
54	39 ^b	1	Norway.	.....	University Museum, Copenhagen.	"

Ophioglypha nodosa LYMAN.

Ophiura nodosa LÜTKEN. Vidensk. Meddelelser. Nov., 1854.

Ophiura nodosa LÜTKEN. Addit. ad Hist. Oph., p. 48.

Special Marks. — Primary plates irregular in form, but regularly arranged; disk thick; arms often twice the diameter of the disk; arm-spines one, two, or three, separated from the tentacle-scales.

Description of a Specimen. — Diameter of disk, 7^{mm.}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 4.3^{mm.}; width of arm without spines, 2^{mm.}; length of arm, 9.5^{mm.}; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 2.9 : 1.5. Mouth-papillæ, ten to each angle of mouth; short, flat, stout, blunt, set close together, those within narrower than the outer ones. Teeth four, remarkably short, resembling mouth-papillæ, flat, stout, with a curved cutting edge. Mouth-shields broader than long, cleanly rounded without, and more or less tapering inwards; length to breadth, 1.6 : 1.2. Side mouth-shields very narrow, occupying only the inner end of mouth-shields; where they meet within, they make an angle, and run still farther inwards, side by side. Under arm-plates rapidly lessening in size towards the tip of the arm; narrow, swollen, rounded without, tapering inwards; first plate largest of all, triangular, with one angle inward, stout, somewhat swollen; length to breadth, .9 : .9; second plate rather smaller, squarish, with rounded corners; beyond this the plates grow more and more rounded

and narrower within. Side arm-plates occupying a large part of the under surface, but not meeting below till about two thirds out on the arm; swollen, thick, rounded, projecting laterally, so as to make vertical creases along the sides of the arm; not meeting above till close to the tip. Upper arm-plates small and swollen, much broader without than within, outer side curved, inner side nearly straight, lateral sides straight; length to breadth (fifth plate), .8:1; the first plate is triangular, and very minute; this and the second plate are included by the notch in the disk; at the point of the arm the plates become triangular, with the outer side rounded. The primary plates of the disk are irregular in shape, stout, and swollen, but are regularly arranged; in the centre of the disk, above, there is a close rosette of six; one in the middle, having a diameter of 1.4^{mm} , and five more, rather smaller, ranged about it; there are two more separate ones in each interbrachial space, of which one is just on the margin of the disk; the spaces between the primary plates are filled with closely crowded smaller scales, of various shapes. Radial shields longer than broad, broader without than within, irregular in shape, corners rounded; joined except at their inner ends, where they are separated by a single scale; length to breadth, 1.5:1.1. Along the free edge of the radial scale, and so passing downwards and inwards along the whole length of the genital slits, is a close row of about eighteen short, stout papillæ, which are longer and more pointed above, and gradually become very minute below; the longest have a length of about $.2^{\text{mm}}$. Arm-spines near base of arm, commonly one, sometimes two, very short, blunt, and rounded; length about $.2^{\text{mm}}$. The tentacle-scales on the inside of the pores resemble the arm-spines, and near base of arm are four or five in number; those on the outer side are similar, but are a little broader and flatter; on the first three or four pores there are two, then one, and, nearer the end of the arm, none; on each side of the innermost tentacle pore are three, sometimes four, scales, in a close row; they resemble the others, but are rather broader. Color, in alcohol, dull gray.

Variations. — The proportions of the arms to the disk may be 5:9, 5:10, 6:10.5, 7:9.5; or, according to Lütken, 6.5:16, or 8.5:17. There may be either one, two, or three arm-spines, near the base of the arm. This irregularity might be expected in such ill-developed parts.

O. nodosa may be told from *O. Sturitzii* by its regularly arranged primary plates, and arm-spines separated from the tentacle-scales; the arms also are longer. It has been found on the coasts of Greenland and Newfoundland.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
40	..	5	Greenland.	.....	Prof. Sars, 1852.	Alcoholic.
41	44	2	Greenland.	.....	University Museum, Copenhagen.	"
42	..	1	Greenland.	.....	Prof. Sars, 1852.	"
43	..	1	Greenland.	.....	.....	Dried.
341	..	7	Straits of Bellisle.	.....	A. S. Packard, Jr.	Alcoholic.
344	..	12+	Straits of Bellisle.	.....	Williams College.	"
<i>Smithsonian Institution.</i>						
1033	..	2	Greenland.	.....	University Museum, Copenhagen.	Alcoholic.

Ophioglypha Stuwitzii LYMAN.

Ophiura Stuwitzii LÜTKEN. Oversigt over Grönlands Echinodermata, p. 51. 1857.

Ophiura Stuwitzii LÜTKEN. Addit. ad Hist. Oph., p. 49.

Special Marks. — Arms very little longer than diameter of disk ; disk thick ; scales on disk irregularly arranged.

*Description of a Specimen.** — Diameter of disk, 5^{mm.} ; from outer side of mouth-shield to outer corner of opposite mouth-slit, 2.5^{mm.} ; width of arm without spines, 1.5^{mm.} ; length of arm about 5.5^{mm.}. Mouth-papillæ numerous ; outer ones very small, inner ones tolerably large, sharp, arranged at the inner point of the jaw in a bunch. Mouth-shields much longer than broad, within pointed, rounded without, lateral sides slightly re-enteringly curved ; length to breadth, 1 : 4. Side mouth-shields short and very narrow, meeting within, and occupying the inner angle of the mouth-shields. Under arm-plates very small, swollen, narrow ; towards the tip of the arm they become smaller and pentagonal. Side arm-plates large, wider above than below, strongly arched, projecting outward and sideways, so that there is a deep crease between each plate and the one next beyond it. Upper arm-plates broader than long, outer side curved, and longer than inner side, which is nearly straight ; lateral sides straight ; length to breadth (second plate), 4 : 8 ; as they go towards the tip of the arm, they grow rapidly narrower, and proportionately longer. Disk scales above, thick, swelled, close, of various shapes and sizes, those towards the centre rather the largest, some

* As the only specimen in the Smithsonian Institution was injured, a part of this description has been taken from Lütken.

having a diameter of 1.2^{mm}; below, scales more regular, thinner, and, on the average, smaller. Radial shields like the other disk-scales, about as broad as long, irregularly angular or rounded, joined without, separated within by a single scale; length, .6^{mm}. The papilla comb at the base of the arm consists of eight rather stout, flattened papillæ, with rounded ends; the uppermost are the largest, and attain a length of .2^{mm}. The papillæ along the edges of the genital slits are fine, sharp, and scattered. Arm-spines (including tentacle-scales) near base of arm, seven, extremely short and blunt, standing close together; those in the middle a little the longest, though hardly more than .1^{mm} in length. The tentacle-scales on the inner side of the pores become, in this species, identical with the lower arm-spines; on the outer side of each pore there are, near the base of the arm, several small, stout tentacle-scales. Color, in alcohol, brownish gray.

Variations. — Dr. Lütken gives the proportion of the arms to the disk as 10 to 6.

O. Stuvitzii has been found at Greenland and at Newfoundland. It is distinguished from *O. nodosa* by differently shaped under arm-plates, and an irregular arrangement of disk-scales.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Smithsonian Institution.</i>						
1032	. .	1	Greenland.	. . . . .	University Museum, Copenhagen.	Alcoholic.

Ophioglypha affinis LYMAN.

Ophiura affinis LÜTKEN. Addit. ad Hist. Oph., p. 45. 1858.

? *Ophiura Normani* HODGE. Trans. Tyn. N. H. Club, Vol. V. Pt. IV. p. 296.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
55	43	3	Oresund.	. . . . .	University Museum, Copenhagen.	Alcoholic.

OPHIOCTEN LÜTKEN.

Disk thick and circular, without notches where the arms join it; partly covered by primary plates and radial shields, between which are fine, close set grains, or small scales, covering the squamous coat; on the interbrachial spaces below, a simple squamous coat, without any covering of grains. A row of papillæ, passing along the genital slits, and upwards, along the margin of the disk, over the arm. Some of the basal upper arm-plates bearing papillæ along their outer edge. Disk cut away at the base of the arm, so as to form a little arch over one or two upper arm-plates which are within the margin of the disk. Side arm-plates meeting below, but not above. Teeth. Mouth-papillæ. No tooth-papillæ. Arm-spines arranged along the outer edge of the side arm-plates. Two genital slits, beginning at the sides of the mouth-shields.

OphiocTEN Kröyeri LÜTKEN.

OphiocTEN Kröyeri LÜTKEN. Vidensk. Meddelelser. Nov., 1854.

Ophiura sericea? FORBES. Sutherland's Journal of a Journey.

OphiocTEN Kröyeri LÜTKEN. Addit. ad Hist. Oph., p. 52.

Special Marks. — Arms three to four times the length of the diameter of the disk; two upper arm-spines much the longest; papillæ of arm-comb continuous; first, second, and third upper arm-plates bearing papillæ; sometimes, also, the fourth.

Description of a Specimen. — Diameter of disk, 8.7^{mm}.; from outer side of mouth-shield to outer corner of opposite mouth-slit, 4.2^{mm}.; width of arm without spines, 1.9^{mm}.; length of arm, 31^{mm}.; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 2.5 : 1.9. Mouth-papillæ, seven or eight to each angle of the mouth; close set, and making an even row; outer one very much the widest, flat, straight, angular; the next two (or three) similar in shape, but much narrower, and more rounded or pointed, innermost one lying directly below teeth, and similar to them, being shaped like a very short, thick, blunt spear-head. Teeth six, set close one above the other, longer than broad, flat, pretty thick, with a blunt point inward; uppermost one narrower than those below. Mouth-shields longer than broad, bounded without by a long, ovoid curve, and within presenting an angle; length to breadth, 1.7 : 1.3. Side mouth-shields meeting within, extremely narrow, but swelling at their outer end into a little knob. Under arm-plates very short, by reason of the

great encroachment of the side arm-plates; bounded without by a gentle curve, and within by two lines a little re-enteringly curved, and converging on the middle line in a slight peak; length to breadth (sixth plate), .3 : 1; sometimes the inner side is bounded by an almost straight line; first plate longer than those beyond, broad triangular, with angles rounded, and one of them directed inward; length to breadth, .7 : .8; second plate of nearly the same shape, but shorter and more rounded. Side arm-plates encroaching below to an unusual degree, so that, at the sixth joint, the length of the line of juncture of the side arm-plates, is to the length of the under arm-plate as .4 : .3; near the end of the arm, almost the whole under surface is occupied by the side arm-plates, the under arm-plates being reduced to little semi-circular scales. Upper arm-plates regular, broader than long, narrower within than without, bounded on outer, inner, and lateral sides by straight lines; length to breadth (fourth plate), .7 : 1.4. Disk plates and grains: above, remarkably flat, and closely soldered together, so that their outlines are hard to see; below, the scales are larger, more swollen, and easily distinguishable; in the centre, above, there is a rosette of six large, round, separated primary plates, the largest having a diameter of about 1^{mm}; there are also a few other smaller primary plates in the brachial and interbrachial spaces; of the disk granules there are about 60 to a square *mm*. Radial shields longer than broad, widely separated, irregular, swelled and rounded without; length to breadth, 1.2 : .8. There is a continuous line of short, pointed papillæ, running along the genital slit, and passing along the edge of the disk, over the top of the arm; of these, those along the genital slits are the most slender; the stoutest papillæ are those standing just over the arm, on the sides, about five in number, and having a length of .2^{mm}; the four or five lying over the arm, on the middle line, are smaller, and stand a little lower; the first, second, third, and sometimes fourth, upper arm-plates have papillæ along their outer side; of these the first plate has the longest. Arm-spines three, rounded, tapering, very sharp; two upper ones much the longest; lengths to that of under arm-plate (sixth joint), 1.1, .9, .5 : .3. Tentacle-scale triangular, as broad as long, with an angle outward; on the first three or four joints an additional scale on the outside of the pore. Color, in alcohol, light gray.

Variations. — A specimen with a disk 11.5^{mm} in diameter had arms about 36^{mm} long; the color, in alcohol, was brownish white; there were ten or eleven mouth-papillæ, the outer broad one being broken in two or three. The species grows as large as 15^{mm} for the diameter of the disk. It has been taken at Spitzbergen (Professor Krøyer), and on the coast of Greenland, in fifteen to twenty fathoms water, muddy bottom (Barrett).

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
32	45	1	Greenland.	.....	University Museum, Copenhagen.	Alcoholic.
<i>Smithsonian Institution.</i>						
1036	..	1	Greenland.	.....	University Museum, Copenhagen.	Alcoholic.

OPHIOLEPIS MÜLL. & TROSCH.

TYPE OF THE GENUS, *O. annulosa*.

Disk covered with radial shields and stout scales; each larger one, above, being surrounded by a belt of smaller ones. Over the base of each arm, a small notch in the disk. Genital scales thick and conspicuous. Teeth. No tooth-papillæ. Mouth-papillæ. Side mouth-shields wide, and nearly, or quite, meeting within. Arm-spines arranged along the outer edge of the side arm-plates. Supplementary pieces to the upper arm-plates. Two genital slits, beginning at the sides of the mouth-shields.

GROUPING OF SPECIES HEREIN DESCRIBED.

Two very short arm-spines,	<i>O. paucispina</i> .
Five to seven short, even arm-spines,	{ <i>O. annulosa</i> .
	{ <i>O. elegans</i> .
Four minute arm-spines. Mouth-shields as broad as long,	{ <i>O. cincta</i> .
	{ <i>O. Garretti</i> .

Ophiolepis paucispina MÜLL. & TROSCH.

Ophiura paucispina SAY. Journ. Phil. Acad., V. p. 149. 1825.

Ophiolepis paucispina. Syst. Asterid., p. 90.

Ophiolepis paucispina LÜTKEN. Addit. ad Hist. Oph., p. 102.

Special Marks. — Only two very short arm-spines; arms about twice as long as the diameter of the disk; under arm-plates considerably broader than long.

Description of a Specimen. — Diameter of disk, 5.2^{mm} ; from outer side of mouth-shield to outer corner of opposite mouth-slit, 2.2^{mm} ; width of arm without spines, 1.3^{mm} ; length of arm, 13^{mm} ; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 1.3 : 1.1. Mouth-papillæ, eleven to each angle of mouth; outermost one conical, sharp, partly overlapping the next one, which is swollen, squarish, broader than long, and the largest one of any; the rest even, close set, about as long as broad, a little swollen, and more or less sharp; innermost one pointing to centre of mouth. Teeth, four; uppermost one tapering, narrow, pointed; the rest broad, flat, even, with a curved cutting edge. Mouth-shields longer than broad, bounded without by a long, ovoid curve, and within by two short, re-enteringly curved lines, which meet, to form an angle on the middle line; length to breadth, .7 : .5. Side mouth-shields stout, having, without, a peak which runs to the inner end of the genital slit. Under arm-plates with inner side curved, outer side either evenly or brokenly curved, and lateral sides re-enteringly curved; much broader without than within, in consequence of the outer corners being prolonged laterally like ears or peaks; length to breadth (sixth plate), .4 : .6; first plate much broader than long; bounded without by an outer side and two outer laterals, and having within a little peak which occupies the outer end of the mouth-slit; towards the end of the arm, the plates have the same general form, but are more elongated, and are bounded without by a very obtuse angle, and within by one which is more acute. Side arm-plates conspicuous, and a good deal swollen, meeting both above and below, near end of arm. Upper arm-plates much narrower within than without; four-sided; outer side a little curved, or wavy; inner side nearly straight; lateral sides re-enteringly curved, and sloping strongly inwards towards the middle line of the arm; length to breadth (eighth plate), .4 : .7; towards the end of the arm the plates are nearly triangular, with a point inward; first three plates very short and rudimentary. Supplementary pieces much wider than long, triangular, with their acute angle directed downward; they are found almost to the very tip of the arm; and, where they are largest, extend downwards nearly to the upper arm-spine; occasionally they are broken in two. In the centre of the disk, above, is a conspicuous primary plate, and from this there radiate ten rows of primary plates, two or three in each brachial row, and three or four in each interbrachial row; these plates are angularly round and swollen, and have an average diameter of about $.5^{\text{mm}}$; in addition, there are in each interbrachial space two more radiating rows of rather smaller scales, one lying on each side of the central row of primary plates, between it and the radial shield; all these are completely separated, each from its neighbor, by close single lines of little, thickened, irregular scales, having an average diameter of about $.2^{\text{mm}}$.

Radial shields irregular, rounded, triangular, rather larger than primary plates; length to breadth, .9:.5; they are separated without by a broadly triangular group of three scales, of which the two outer ones are two or three times as large as the inner one, and within by a group of little scales, in the midst of which stands the outermost primary plate of the brachial row. Interbrachial spaces below closely covered with large scales similar to those above, but rather smaller and flatter; between these there are some little angular scales, which, however, do not completely separate them. Arm-spines two, stout, rounded, tapering, extremely short; length less than .2^{mm}. Tentacle-scales two; near tip of arm only one; stout, thick, set close together, and forming an oval figure. Color, in alcohol: below, whitish; above, yellowish white, with some bands of dark greenish on the arms, and a few markings of the same color on the disk.

Variations. — The arms generally are not more than twice the diameter of the disk in length; the largest specimen I have seen had a disk of 7^{mm}, and arms of 14.5^{mm}. I have seen none smaller than 3.8^{mm}; and this one showed all the adult characters, except that the inside tentacle-scale was not fully developed. The color of the living animal is said to be yellowish, reddish, or grayish, with dark-green arm-bands.

This species has been found by Mr. Riise at St. Thomas, and by Prof. Agassiz and Mr. Wurdeman on the coast of Florida, where Say, also, originally discovered it. It differs from other species in having only two very short arm-spines.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
204	..	6	St. Thomas, W. I.	.....	A. H. Riise.	Alcoholic.
205	..	2	Florida.	.....	G. Wurdeman.	"
206	55	2	West Indies.	.....	University Museum, Copenhagen.	"
207	..	1	Cape Florida.	Apr. 1858.	G. Wurdeman.	"
<i>Smithsonian Institution.</i>						
1162	..	4	St. Thomas, W. I.	.....	A. H. Riise.	Alcoholic.
1115	..	3	St. Thomas, W. I.	.....	A. H. Riise.	"
1182	..	2	St. Thomas, W. I.	.....	A. H. Riise.	Dried.

Ophiolepis annulosa MÜLL. & TROSCH.*Ophiura annulosa* DE BLAINV. (*non* Lamk.). Man. d'Actin., p. 244. 1834.*Ophiolepis annulosa* MÜLL. & TROSCH. Syst. Asterid., p. 89. 1842.*Ophiolepis annulosa* LÜTKEN. Addit. ad Hist. Oph., II. pl. II. fig. 5.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
203	..	4	Zanzibar.	.....	G. A. Cheney.	Alcoholic.
402	Zanzibar.	.....	C. Cooke.	"

Ophiolepis elegans LÜTKEN. (Plate II. Fig. 5.)*Ophiolepis elegans* LÜTKEN. Addit. ad Hist. Oph., p. 105.

Special Marks. — Arms rather less than three times the diameter of the disk. Primary plates very flat and regular; a rosette of six in the centre of the disk; a single row of three in each interbrachial space, and one primary plate in each brachial space.

Description of a Specimen. — Diameter of disk, 17^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 6^{mm}; width of arm without spines, 4.2^{mm}; length of arm, 48^{mm}; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 3.6 : 2.9. Mouth-papillæ eleven, close set in an even row; outermost one tapering and sharp, slightly overlapping the next one, which is the broadest of all, being about twice as broad as long; the rest squarish, with bevelled, cutting edges; innermost one pointing to centre of mouth. Teeth four, regularly decreasing in width from below upwards; three lowest ones broad and flat, with a neatly curved cutting edge; uppermost one narrower and more pointed. Mouth-shields much longer than broad, with their outer side curved, lateral sides straight, and inner laterals short, a little re-enteringly curved, and meeting in an angle on the middle line; length to breadth, 2 : 1. Side mouth-shields as broad as mouth-shields, hardly curved, having without a point which runs to the inner end of the genital slit. Under arm-plates broader than long, a trifle narrower within than without, squarish, with rounded corners, outer and inner sides nearly straight, lateral sides a little re-enteringly curved; length to breadth (seventh plate), 1 : 1.6; towards the end of the arm, the plates are broader with-

out than within, bounded within by a short, straight inner side, and two inner laterals; on the lateral sides by slightly re-entering curves, and without by a curved or wavy outer side; these plates somewhat resemble the basal plates of *O. paucispina*; first plate much broader than long, nearly oval, with an inward projection filling the end of the mouth-slit. Side arm-plates very regularly arched, occupying a portion of the under surface of the arm more than equal to the width of the under arm-plates. Upper arm-plates regular, broader than long, bounded without and within by straight lines, and laterally by short curves; length to breadth (fourth plate), 1:2; farther out they become regularly hexagonal, and, at the tip of the arm, fan-shape. Supplementary pieces, long triangular, with their point downward; length to breadth (seventh joint), .5:1. The arrangement of the upper plates of the disk is extremely regular, and is as follows: in the centre a rosette of six angular primary plates, of which the central one is the smallest, the others having a diameter of about 2^{mm} ; from this group radiate five interbrachial rows, each of three primary plates; in the brachial spaces there is a single primary plate, between the inner ends of the radial shields and the central rosette; each primary plate is surrounded by a single line of about eighteen small angular scales, lying on the same level with the larger plates. Radial shields pear-seed shaped, their points inwards; large, somewhat swollen; widely separated, without, by a broad triangle of three scales, of which the two outer ones are rounded and much swollen, and within by a large scale, with its belt of smaller ones; a part of the above-mentioned primary plate also lies between the inner ends of the radial shields; their length to breadth is 3.2:2.2. Interbrachial spaces below covered without by a triangle of three very large, much swollen scales, and within by three cross rows of smaller and flatter scales; the outer genital plate is much enlarged, and makes a conspicuous ridge. Arm-spines, near base of arm, six; farther out, five; very short, rounded, and blunt, scarcely tapering; lengths to that of under arm-plate, .3 (or .4):1. Tentacle-scales two, forming together a nearly oval figure; on the outer side of each pore there is a stout triangular piece, that may be considered as homologous with a similar part often found in *Ophioglypha*; besides this there is on the basal pores a minute edge attached to the lateral side of the under arm-plate. Color, in alcohol: below, pure white; above, disk clouded with pale greenish-gray and white, many of the primary plates surrounded by a line of fine brown specks; arms alternating with bands of darker and lighter greenish-gray, the upper surface of the side arm-plates being in the latter bands white.

Variations. — The above description was taken from a Florida specimen; three dried ones, from Charleston, S. C., seem to belong to the

same species; they present no structural variation, except that sometimes there are three instead of two large scales, in a straight line, between the radial shields; the largest specimens have the disk to the arms, as 21:58. The supplementary arm-plate pieces are sometimes cut in two. Drawings belonging to Professor Agassiz show that the living animals (from Charleston) vary in color; in one, the upper surface of the disk is vandyke brown, the central primary plate being light yellow, and the other primary plates surrounded by specks of white or of brown; the upper arm-plates are like the disk, and bear specks of white; the side arm-plates yellow; in another, there is a large, oblong, light-yellow spot in the middle of the disk, and a smaller round spot in each interbrachial space, all these being limited by black dots; the rest of the disk is mottled with brownish and greenish gray, and some black dots; the side arm-plates are light yellow, and the upper arm-plates lighter or darker greenish-gray, making bands. Occasionally one or two of the lower teeth are split in two.

This species is distinguished by its regular back plates, and numerous arm-spines.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
208	..	1	Florida.	.....	G. Wurdeman.	Alcoholic.
209	..	2	Charleston, S. C.	.....	Prof. Agassiz.	Dried.
210	..	1	Charleston, S. C.	.....	Prof. F. S. Holmes.	"

Ophiolepis cincta MÜLL. & TROSCH.

Ophiolepis cincta MÜLL. & TROSCH. System der Asteriden, p. 90.

Ophiolepis cincta LÜTKEN. Addit. ad Hist. Oph.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
400	Zanzibar.	.....	C. Cooke.	Alcoholic.
401	Society Islands.	.....	A. Garrett.	"

Ophiolepis cincta, M. T.**Ophiolepis Garrettii** LYMAN. (Pl. II. fig. 4.)

Special Marks.—Arms six times the diameter of the disk, not tapering till just at the end; mouth-shields as broad as long.

Description of a Specimen.—Diameter of disk, 9^{mm}.; width of arm, without spines, 2^{mm}.; length of arm, 55^{mm}. Mouth-papillæ, five on each side, and one under the teeth, those on the sides flat, stout, squarish, crowded; the outer one sends a slender prolongation above and beside the next papilla. Teeth regular, broader than long, with a rounded cutting edge. Mouth-shields neatly rounded without, and with an acute angle within; length to breadth, .9:1; their outer edge is bordered by a line of little, crowded, angular pieces, one of which is inserted between the mouth-shield and side mouth-shield, at each corner. Side mouth-shields large, of equal width along their length; within separated by one or two supplementary pieces. Under arm-plates longer than broad, broader without than within; outer side curved, lateral sides re-enteringly curved; length to breadth (seventh plate), .9:.7. Side arm-plates thick and swelled. Upper arm-plates, broader than long, broader without than within, swelled; length to breadth (ninth plate), .5:1.3. The supplementary pieces are small and crowded, the one at each outer corner being largest; they are at the base of the arm, from seven to ten. The scaling of the disk is very regular, the scales being a little smaller below than above; diameter of the largest nearly 1^{mm}.; each has its free edge bordered by a line of crowded and regular pieces, which are commonly about seven in number. Radial shields irregular oval, separated by two large scales, one outside the other, and two smaller ones lying side by side. Arm-spines four, very small and slender, confined to the middle of the edge of the side arm-plate; lowest one longest, .5^{mm}. long. Tentacle-scales two, rarely three, stout, thick, forming together an oval figure, which stands obliquely to the length of the arm. Color, in alcohol: disk, pale reddish-yellow, with bands of darker on the arms; below, grayish. The living animal has a brick-red disk, with paler bands on the arms; the lower surface much paler (Garrett).

This species is distinguished from *O. cincta* by shorter mouth-shields and much longer arms. The best distinguishing mark, however, is the microscopic appearance of granulation which the upper arm-plates have, while in *O. cincta* they are smooth and glossy.

*They are
the same*
U. I.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
331	..	1	Kingsmills Islands.	.....	A. Garrett.	Alcoholic.

OPHIOCERAMIS* LYMAN.

Ophiolepis MÜLL. & TROSCH., pars.

Disk covered with radial shields and stout scales, none of which are surrounded by a belt of small ones. Over the base of each arm, a small notch in the disk. Genital scales concealed. Teeth. Tooth-papillæ. Mouth-papillæ. Side mouth-shields small, and not meeting within. Arm-spines arranged along the outer edge of the side arm-plates. No supplementary pieces to the upper arm-plates. Two genital slits, beginning outside the mouth-shields.

Ophioceramis Januarii LYMAN.

Ophiolepis Januarii LÜTKEN. Vidensk. Meddelelser. Jan., 1856.

Ophiolepis Januarii LÜTKEN. Addit. ad Hist. Oph., p. 108.

Special Marks. — Arms four and a half or five times the diameter of the disk, which grows as large as 19^{mm}. Three (sometimes four) arm-spines, the middle one longest; all of them stout, tapering, and flattened.

Description of a Specimen. — Diameter of disk, 19^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 7.5^{mm}; width of arm without spines, 4.5^{mm}; length of arm, about 82^{mm}; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 2.8 : 3.6. Mouth-papillæ four on each side, small, rounded, flattened, and close set; outermost one sharp, and over-

* ὄφις, snake; κεραμῖς, tile.

lapping the second, which is the largest of all; the space below the tooth-papillæ is commonly vacant, but is sometimes occupied by two very small mouth-papillæ. Tooth-papillæ two; narrow, long, and a little curved, touching each other below, but diverging upwards, leaving a triangular space, which is filled by the lowest tooth.* Teeth ten, flattened, squarish, with a wavy cutting edge, which is re-enteringly curved, and thickened at its middle point; lowest one more or less modified by the two tooth-papillæ; the next four of even width, and broader than the five uppermost ones. Mouth-shields rounded, about as long as broad, with a curve within and a rounded angle without; length to breadth, 1.8 : 1.6. Side mouth-shields irregular, and very small. Under arm-plates much broader than long, broader without than within; outer and inner sides curved; lateral sides strongly re-enteringly curved; outer corners prolonged laterally, as little peaks; length to breadth (eighth plate), 1.1 : 2.2; first plate very small, rounded diamond-shape; breadth 1^{mm}.; towards the end of the arm the plates become proportionately much longer, but the curves of their sides remain about the same. Side arm-plates not encroaching above or below; considerably thickened along their outer edge, to afford a base for the strong arm-spines. Upper arm-plates much broader than long; broader without than within, with outer corners well rounded; they are divided on the middle line into two quite distinct pieces, very rarely into three or even four pieces; the two or three first plates are short and rudimentary, and are enclosed by the notch in the disk. Disk-scales closely overlapping; in the centre a circular, primary plate, about 1.5^{mm}. in diameter; four primary plates may be indistinctly seen in each interbrachial, and three in each brachial space; on the interbrachial spaces below, the scales are narrow, close, small, and even, having an average length of about .7^{mm}.; at the base of each arm, there are very fine scales, which often run out a little way on the side of the arm, much as in *Ophiura*. Arm-spines three (near base of arm, sometimes four), stout, strongly tapering, rounded, a good deal flattened; middle one longest; lengths to that of under arm-plate (thirteenth joint), 1.7, 2.5, 2 : 1.1; the upper spine often is suddenly enlarged at the base. Tentacle-scales small, rounded, flattened, a little longer than broad, standing close together; near the base of the arm there are two outside and two inside each pore; but farther out the two outer ones become smaller and smaller, and are soon reduced to a little edge, lying along the lateral side of the under arm-plate. Color, in alcohol: yellowish vandyke-brown, above; below, the same, but lighter and more yellowish.

* These might almost as well be termed *mouth-papillæ*, except that they do not lie quite on a level with the rest. The innermost papillæ in *Amphiura* are similar, but descend, so as to form part of the row of mouth-papillæ, among which they are included.

This large and very characteristic species has been taken at Rio Janeiro by Professor Kröyer.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Smithsonian Institution.</i>						
1026	. .	1	Rio Janeiro.	. . . . .	University Museum, Copenhagen.	Alcoholic.

OPHIOZONA* LYMAN.

*Ophiopsis** MÜLL. & TROSCII, pars.

Disk covered with radial shields and stout scales, each larger one, above, being surrounded by a belt of smaller ones. Over the base of each arm, a small notch in the disk. Genital scales thick and conspicuous. Teeth. No tooth-papillæ. Mouth-papillæ. Side mouth-shields wide, and nearly, or quite, meeting within. Arm-spines arranged along the outer edge of the side arm-plates. No supplementary pieces to the upper arm-plates. Two genital slits, beginning at the sides of the mouth-shields.

GROUPING OF SPECIES HEREIN DESCRIBED.

Arm-spines nearly as long as arm-joints ; lowest ones longest,	<i>O. impressa.</i>
Arm-spines very short, and of equal lengths,	<i>O. pacifica.</i>

Ophiozona impressa LYMAN. (Fig. 4.)

Ophiopsis impressa LÜTKEN. Addit. ad Hist. Oph., p. 101.

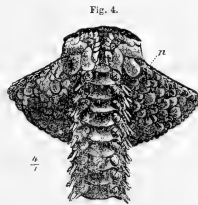
Special Marks.—Arms four or five times the diameter of the disk. Five moderately stout arm-spines ; the two lowest longest, and nearly as long as the arm-joints. Disk-scales overlapping, the larger ones nearly circular.

* *ὄφις, snake ; ζώνη, belt.

Description of a Specimen.—Diameter of disk, 15.5^{mm} ; from outer side of mouth-shield to outer corner of opposite mouth-slit, 6^{mm} ; width of arm without spines, 3.1^{mm} ; length of arm, 64^{mm} ; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, $2.5 : 3.3$. Mouth-papillæ eleven; outermost one slender, tapering, sharp, overlapping the next to it, which is broader than long, and stout; rest of papillæ short, stout, pointed, somewhat rounded; the whole form a close, even row. Teeth five or six, regularly decreasing in width, from below upward; short, flat, regular, with a curved cutting edge. Mouth-shields longer than broad, bounded without by a long, ovoid curve, and within by two short lines, which are a little re-enteringly curved, and meet to form an angle on the middle line; length to breadth, $1.4 : 1$. Madreporic shield with a deep, round depression. Side mouth-shields thick, swollen,

slightly curved, having a little peak without, running up to the inner end of the genital slit. Under arm-plates squarish, small, bounded without by a slight curve, within and on the lateral sides by re-entering curves; outer corners projecting; length to breadth (eighth plate), $1 : 1.5$; first plate shaped like the segment of a circle, with the curve outward, and having a little projection within, occupying the outer end of mouth-slit; towards the tip of the arm, the plates are proportionately longer, but have the same general outline. Side arm-plates pretty large, and occupying

a good deal of upper and under surfaces of the arm, but not meeting either above or below, even near its tip. Upper arm-plates broader than long, broader without than within; outer side slightly curved, inner and lateral sides straight, outer corners cleanly rounded; length to breadth (seventh plate), $1 : 2$; first two or three plates enclosed by notch in disk, and modified in breadth accordingly, short, thin, rudimentary; length to breadth of third plate, $.6 : 1.8$; towards tip of arm, the plates are quadrangular, but with so short an inner side as to be almost wedge-shape. In the centre of the disk, above, a rosette of six separated, nearly circular primary plates, having a diameter of about 1^{mm} ; in each interbranchial space, above, five radiating rows of similar separated plates or scales, the middle row being composed of four primary plates; between all these are numerous little scales, having a diameter usually of $.5^{\text{mm}}$, and arranged usually in single lines. Radial shields pear-seed shaped, the point inward; length to breadth, $2.2 : 1.4$; widely separated without by a triangle of three large round scales, and within by a single large oval scale, between which and the triangle are



Ophiopoda impressa. (Lower side.)
n, genital scales.

several smaller scales; scales of interbrachial spaces below, smaller and thinner than those above. Arm-spines five, short, moderately stout, tapering, rounded, uppermost one shortest, two lowest ones rather the stoutest; lengths to that of under arm-plate (seventh joint), .6, .7, .7, .9, .9:1; near end of arm, only three spines; and even near its base, there are often only four. Tentacle-scales two, stout, longer than broad, set close to each other, and forming together an oval. Color, in alcohol: above, disk-scales and arm-plates vandyke-brown, some of them edged or mottled with white; arms irregularly banded with burnt umber; below, arms and mouth parts faint yellowish-brown; interbrachial spaces nearly white, with a tinge of greenish.

Variations.—The larger disk-scales are in some specimens more prominent and distinct than in others; occasionally there are only three, instead of five, radiating rows of larger scales, in each interbrachial space above. The color, in alcohol, varies a little in intensity. The proportions of the arms to the disk may be as 9.2:36, 11:41, 12.5:66, 13.2:51, 14:57, or 15.5:64.

O. impressa has been taken at St. Thomas, in from one to four feet of water, on a sandy bottom, or on corals (A. H. Riise); also on the coast of Florida (Professor Agassiz, Mr. Wurdeman). It may be distinguished from *O. pacifica* by having longer arm-spines, which are not of equal lengths.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
212	..	3	St. Thomas, W. I.	.....	A. H. Riise.	Alcoholic.
213	54 ^b	2	West Indies.	.....	University Museum, Copenhagen.	"
214	..	1	Florida.	.....	Prof. Agassiz.	Dried.
<i>Smithsonian Institution.</i>						
1080	..	1	St. Thomas, W. I.	.....	A. H. Riise.	Dried.
1085	..	2	St. Thomas, W. I.	.....	A. H. Riise.	"
1099	..	2	St. Thomas, W. I.	.....	A. H. Riise.	Alcoholic.
1161	..	2	St. Thomas, W. I.	.....	A. H. Riise.	"

Ophiozona pacifica LYMAN.*Ophiolepis pacifica* LÜTKEN. Vidensk. Meddelelser. Jan., 1856.*Ophiolepis pacifica* LÜTKEN. Addit. ad Hist. Oph., p. 104.

Special Marks. — Arms three or four times the diameter of the disk. Arm-spines four or five, very small, and of even length.

Description of a Specimen. — Diameter of disk, 4.7^{mm}; from outer side of mouth-shields to outer corner of opposite mouth-slits, 2.3^{mm}; width of arm without spines, 1.1^{mm}; length of arm, 18^{mm}; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 1.1 : 1. Mouth-papillæ, eleven to each angle of mouth, small, close set, flat, angular, squarish; outermost one somewhat pointed, and slightly overlapping its next neighbor, which is much the largest of all. Teeth four, flat, broad, with a curved cutting edge; uppermost one narrowest. Mouth-shields much longer than broad, bounded by an ovoid curve without, and by an angle within; length to breadth, .6 : .4. Side mouth-shields swollen, triangular, large; running out, with one corner, to the head of the genital slit. Under arm-plates broader than long, broader without than within; outer and inner sides strongly re-enteringly curved; length to breadth (sixth plate), .4 : .6; first plate nearly oval, as broad as the following plates, with a projection within filling the outer end of the genital slit; at the tip of the arm the plates are sharp wedge-shaped. Side arm-plates occupying a good deal of upper and under surface, but not meeting above and below till about two thirds out on the arm. Upper arm-plates very regular, a good deal broader without than within, four-sided, the sides almost perfectly straight; length to breadth (sixth plate), .4 : .8; the notches in the disk are so shallow that only one rudimentary plate is admitted. In the centre of the disk, above, is a large, nearly round, primary plate, .6^{mm} in diameter, surrounded by five little triangular scales; outside these is a circle of five large oval plates, one in each brachial space; the interbrachial spaces have three radiating rows of plates, those of the central row being the largest; there are also a few very small scales scattered among the others. Radial shields sunken, irregular, longer than broad, running to the edge of the disk, separated by a single row of three scales; their outer ends bounded by two large, narrow, curved scales; length to breadth, .9 : .6. Interbrachial spaces, below, covered with nearly equal scales, with some little ones among them; genital slits bordered by three narrow scales, of which the outer one is longest and widest. Arm-spines four, very small, of even length, cylindrical, tapering, about one third as long as

the arm-joints. Tentacle-scales two, lying obliquely, and forming together a very regular oval. Color, in alcohol: white, with a few light-grayish bars on the arms, and cloudings of the same tint on the disk.

Variations. — The above description was taken from a young specimen. According to Dr. Lütken, the adult has a disk of 10^{mm}, and arms of 30 or 40^{mm}. There are five arm-spines also.

O. pacifica has been found at Puntarenas (Dr. Örsted) in one fathom water, and at Panama (Alex. E. R. Agassiz). It differs from *O. impressa* in the smallness and regularity of the arm-spines.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
211	..	1	Panama.	.....	Alex. Agassiz.	Alcoholic.

OPHIOPLOCUS* LYMAN.

Disk closely and finely scaled above and below. Genital scales hidden. Teeth. No tooth-papillæ. Mouth-papillæ. Side mouth-shields wide, and nearly, or quite, meeting within. Arm-spines arranged along the outer edge of the side arm-plates. Upper arm-plates divided on the middle line into halves, which at the base of the arm are placed at the outer lower corner of the joint, on each side being separated by a number of supplementary pieces. At the tip of the arm the plate is simple; then it divides in two, and the halves are gradually forced apart by the intrusion of supplementary pieces. Two short genital slits, extending only half-way to the margin of the disk, and beginning outside the mouth-shields.

* ὄφις, snake; πλόκος, a twisted rope.

Ophioplocus imbricatus LYMAN.*Ophioplocus imbricatus* MÜLL. & TROSCHE. System der Asteriden, p. 93.*Ophioplocus tessellatus* LYMAN. Proc. Boston Soc. Nat. Hist., VIII. p. 76. 1861.

Special Marks. — Color gray, with obscure cross-bands on the arms ; length of arms, in adults, four to five and a half times the diameter of the disk.

Description of a Specimen. — Diameter of disk, 17^{mm} ; width of arm without spines, 3.5^{mm} ; length of arm, 70^{mm} ; mouth-papillæ, five on each side, and one odd one, placed just under the teeth ; the side papillæ squarish, flat, and crowded, the odd one resembling the teeth. Teeth five, thick, short, stout, broader than long, with a curved cutting edge. Mouth-shields broad heart-shape, with a curve without and an angle within ; length to breadth, 1 : 1.5. Side mouth-shields large, and of even width, $.5^{\text{mm}}$ wide. Under arm-plates squarish, very regular and clear in outline, slightly separated, thick ; outer side curved, lateral sides a little re-enteringly curved ; length to breadth (tenth plate), 1 : 1.3. The halves of the upper arm-plates are rounded triangular, very much like the supplementary pieces in *Ophionereis* ; at the base of the arm they lie very low down, so that the side arm-plates are much reduced in size ; they are separated from each other by six supplementary pieces, of which one lies on the middle line of the arm, and the other five make a sort of semicircle round it ; at the base of the arm the central piece of this semicircle becomes very small indeed, and is often divided in two ; between the supplementary pieces there are sometimes single large grains. The halves of the upper arm-plates and the supplementary pieces are thick and swelled, and often of about the same size. Side arm-plates small, and almost covered up by the arm-spines. Scales of the disk a little larger above than below, mostly overlapping, but with here and there a round scale, varying somewhat in size, the largest $.8^{\text{mm}}$ long. Radial shields very small, about 1^{mm} long, sunken in the scaling of the disk. Genital slits only 2^{mm} long, starting 1^{mm} outside the mouth-shield. Arm-spines three, stout, round, blunt ; the lowest much the largest ; lengths to that of under arm-plate, .8, 1, 1.3 : 1. Tentacle-scales two, longer than broad, flat, nearly oval. Color, in alcohol : gray, with very obscure cross-bars of darker on the arms. According to a colored sketch by Mr. Garrett, the tints of the living animal are about the same.

Variations. — The characters of fifteen specimens which I have examined were very uniform, only the young have shorter arms. The proportions of the disk to the arms in specimens of different sizes

was 9.5 : 30, 16 : 68, and 19 : 93. The radial shields vary a little in size and distinctness.

I have satisfied myself that this is the same species as the *Ophiolepis imbricata* of Müller & Troschel, whose imperfect description at first led me to describe it as new.

LIST OF SPECIMENS.

Catalogue Number.	Original Number of Spec.		Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
328	5	1	Kingsmills Islands.	.....	A. Garrett.	Dried.
329	..	12+	Kingsmills Islands.	.....	A. Garrett.	Alcoholic.
408	..	..	Zanzibar.	.....	C. Cooke.	"

OPHIOCOMA. AGASSIZ.

TYPE OF THE GENUS, *O. scolopendrina* Agass.

Disk granulated. Radial shields covered. Teeth, tooth-papillæ, and mouth-papillæ. Spines, usually from four to six; smooth; arranged along the sides of the side arm-plates. One or two tentacle-scales. Two genital slits, beginning outside the mouth-shields.

NOTE ON SOME SPECIES OF THE GENUS OPHIOCOMA.

Ophiocoma dentata Müll. & Trosch., of which the original is in the Berlin Zoölogical Museum (No. 931), is not a good species, and seems only a middling sized *Ophiocoma echinata*. The species described by Dr. Lütken as *O. dentata* is quite another thing, and seems to be *O. brevipes* (Addit. ad Hist. Oph., p. 165).

Ophiocoma variabilis Grube (Acad. Cæs. Nova Acta, 1860) is, according to the plate and the description, only a partly grown specimen of *O. Schænleinii*, or of some allied species. *O. Schænleinii* itself is rather a dubious species. The originals at Berlin (Zoöl. Mus., No. 930, and Anatom. Mus., 11561) look like some varieties of *O. erinaceus*, the chief difference being that most of the tentacle-pores have but one tentacle-scale. The same doubts may be raised about *O. Wendtii* (Berlin Zoöl. Mus., No. 929), whose chief distinguishing marks are the absence of the second tentacle-scale on most of the joints, and the peculiar form of the basal under arm-plates. It may turn out that *O. Wendtii* and *O. Schænleinii* are the same species.

Ophiocoma tumida Müll. & Trosch. The original, in the Leyden Museum, is marked "Gulf of Genoa"; but this looks like a mistake. I do not remember to have seen any *Ophiocoma* at all from the Mediterranean, much less one which in size and appearance closely resembles *O. echinata*. *O. bidentata* Müll. & Trosch. is plainly a worthless species, and *O. Nilssonii* Müll. & Trosch. probably goes in the same category.

		GROUPING OF SPECIES HEREIN DESCRIBED.	
One tentacle-scale,	{		<i>O. Valencia.</i>
			<i>O. pumila.</i>
			<i>O. Alexandri.</i>
			<i>O. Riisei.</i>
Two tentacle-scales,	{	Near base of arm, sometimes two tentacle-scales,	<i>O. aethiops.</i>
		Arm-spines about equal,	<i>O. nigra.</i>
		Upper arm-spines longest,	<i>O. echinata.</i>
			<i>O. erinaceus.</i>
			<i>O. scolopendrina.</i>
		Lowest arm-spine longest,	<i>O. insularia.</i>
		Six slender arm-spines; disk and arms lined and spotted,	<i>O. pica.</i>
		Disk granulation very fine and close; spines regular,	<i>O. brevipes.</i>

Ophiocoma Valenciæ MÜLL. & TROSCH.

Ophiocoma Valenciæ MÜLL. & TROSCH. Syst. Asterid., p. 102.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
306	..	4	Zanzibar.	.....	G. A. Cheney.	Alcoholic.
357	Mozambique.	.....	C. Cooke.	"
356	Zanzibar.	.....	Capt. Webb.	"

Ophiocoma pumila LÜTKEN.

Ophiocoma pumila LÜTKEN. Vidensk. Meddelelser. Jan., 1856.

Ophiocoma placentigera LÜTKEN. [Labelled specimens.]

Ophiocoma pumila LÜTKEN. Addit. ad Hist. Oph., p. 146.

Special Marks. — Commonly five arm-spines; first or second spine longest.

Description of a Specimen. — Diameter of disk, 13^{mm.}; from outer edge of mouth-shield to outer corner of opposite mouth-slit, 5^{mm.}; greatest width of arm without spines, 2.2^{mm.}; length of arm about 75^{mm.}; distance from outer edge of mouth-shields to inner point of tooth-papillæ, to that between outer corners of mouth-slits, 2.5 : 2.5. Mouth-papillæ short, stout, longer than broad, much rounded, often nearly egg-shaped, somewhat irregularly disposed; innermost one more pointed and tooth-like; about fourteen to each angle of mouth. Tooth-papillæ

about twelve, in four irregular horizontal rows; stout, rounded, a little longer than broad, pretty closely set. Teeth four, longer than broad, flat, square, inner edge narrower than outer edge; two middle ones largest, upper one much narrower than others. Mouth-shields rounded square, a little longer than broad; length to breadth, 1.5:1.3. Side mouth-shields extremely small, variable in size, occupying a triangular space between outer part of mouth-shield and innermost arm-plate. Under arm-plates more or less octagonal, those lying within the margin of disk smaller than those just beyond. Innermost plate rudimentary, scarcely larger than mouth-papillæ next it; second plate nearly square, with outer corners rounded, length to breadth, .8: .8; next three plates nearly regular octagons; eleventh plate slightly curved without, lateral sides straight, inner laterals rather longer than inner side proper, length to breadth, 1.1: .9; this is the common shape of the under arm-plates, and is retained till very near the tip of the arm. Side arm-plates encroaching somewhat on both upper and under arm-plates. Upper arm-plates very broad heart-shaped, outer side and corners regularly curved, inner laterals sloping towards each other, and nearly meeting within. First plate rudimentary, and nearly covered by granulation of disk; second, third, and fourth plates more or less oval, and all smaller than those that immediately succeed; sixth plate of usual shape and size, length to breadth, 1.2: 1.7; this proportion holds the same (though the plates grow smaller) close to the tip of the arm. Granulation of upper surface of disk rather coarse, grains shaped like mouth-papillæ, some longer than their neighbors, about 30 to a square *mm.* Granulation extended on arm so as nearly to cover first upper arm-plate; below, a broad naked belt parallel with genital slits; remaining triangular space granulated, quite up to mouth-shields; grains less close and rather more tooth-like than those above. Edges of genital slits more or less finely toothed. Arm-spines neatly rounded and tapering, slightly flattened. Second and third joints, three slender flattened spines, about .7^{mm.} long; fourth and fifth joints, four spines, about 1.2^{mm.} long; sixth, seventh, eighth, and ninth joints, five spines; tenth joint, four spines, decreasing in length and thickness from above below; length of upper spine to that of lowest, 2: 1.3; two upper spines considerably stouter than two lowest. This number and proportion holds till near the tip of the arm; the spines grow more slender, however, and the second is sometimes longer than the upper one. Close to tip of arm only three spines. Tentacle-scales pointed oval, like a broad spear-head; on second, third, and fourth joints two, on rest only one. Color, in alcohol: above, vandyke brown, paler towards centre of disk; arms banded with lighter, each band occupying two or three joints; also some white spots on edges of upper arm-plates; below, very faint brown; chewing apparatus, mouth-shields, and under arm-plates nearly white, the latter often with

a light-brown pattern; under arm-spines nearly white; upper spines pale brown at their base, lighter at the point.

Variations. — A specimen with a disk 15^{mm}. had arms 75^{mm}.; uniform vandyke-brown above, and same below, but paler, with a few spots and bands near end of arms and on under-arm-plates; mouth-shields a little broader than long, and nearly circular; granulation of disk in inter-brachial spaces below reaching nearly to genital slits on either side; two or three of side mouth-papillæ soldered together, making one broad one; only three rows of tooth-papillæ; five joints each with two tentacle-scales, rest with only one. A specimen with a disk of 16^{mm}. had arms of 115^{mm}. which shows a range of length, in grown specimens, of from five to seven times. Lütken gives the length as over eight times the diameter of the disk. — *Young*, said to be this species (original *O. pumila* Ltk.): diameter of disk, 2.5^{mm}.; length of arms, 12.5^{mm}.; disk covered with fine scales, over which are scattered a few grains, or rather short spines. Upper arm-plates long heart-shaped, i. e. bounded without by a strong curve, and on sides by two straight lines, meeting within. Side arm-plates meeting above and below. Under arm-plates longer than broad, outer side curved, laterals re-enteringly curved, inner laterals straight, and meeting within. One tentacle-scale. Only two tooth-papillæ. Mouth-shields heart-shaped, longer than broad. Arm-spines four, at base of arm; rather more slender than in adult, and a little rough. Color, in alcohol: pale yellowish-brown above, arms barred with whitish, and six in number.

This species is distinguished from the more common type of *Ophiocoma*, by its long flattened arms, and less robust structure.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
291	..	2	Florida.	.....	Prof. Agassiz.	Alcoholic.
292	..	1	Tortugas, Fla.	Apr. 22, '58.	J. E. Mills.	"
293	..	1	Tortugas, Fla.	Mar. 19, '58.	J. E. Mills.	"
294	..	1	Key West, Fla.	Jan. 28, '58.	J. E. Mills.	"
295	..	3	Cape Florida.	.....	G. Wurdeman.	"
296	..	1	St. Thomas, W. I.	.....	A. H. Riise.	"
297	..	2	Jeremie, Hayti.	.....	Dr. D. F. Weinland.	"
298	62 ^a	2	West Indies.	.....	Univ. Mus. Cophagen.	"
299	62 ^b	1	West Indies.	.....	Univ. Mus. Cophagen.	"
<i>Smithsonian Institution.</i>						
1050	..	1	Florida.	.....	.....	Alcoholic.
1001	..	1	St. Thomas, W. I.	.....	Univ. Mus. Cophagen.	"
1163	..	1	St. Thomas, W. I.	.....	A. H. Riise.	"
1075	..	1	St. Thomas, W. I.	.....	A. H. Riise.	Dried.
1102	..	3	St. Thomas, W. I.	.....	A. H. Riise.	Alcoholic.

Ophiocoma Alexandri LYMAN.

Ophiocoma Alexandri LYMAN. Proceed. Boston Soc. Nat. Hist., VII. p. 256. 1860.

Special Marks. — Grayish or yellowish brown. Arms banded; five to seven spines; third or fourth spine longest.

Description of a Specimen. — Diameter of disk, 17^{mm} ; from outer side of mouth-shield to outer corner of opposite mouth-slit, 5.5^{mm} ; width of arm without spines, 3.3^{mm} ; length of arm, 120^{mm} ; distance from outer side of mouth-shield to inner points of tooth-papillæ, to that between outer corners of mouth-slits, $2.7 : 3$. Mouth-papillæ flat, rounded, of nearly equal size, rather small; nine or ten to each angle of mouth. Tooth-papillæ bead-like, crowded, most of them in two vertical rows; about nine in number, the upper middle one larger than the others. Teeth three or four, stout, flat, a little tapering. Mouth-shields nearly round, with inner end slightly truncated; length to breadth, $1.6 : 1.6$. Side mouth-shields very narrow and small, occupying the inner part of mouth-shield, but not meeting within. Under arm-plates very regular, not overlapping, rounded octagonal, inner angles less rounded than outer; the plates within the disk a good deal smaller than those beyond; length to breadth (twentieth plate), $1.2 : 1$. Side arm-plates encroaching somewhat above. Upper arm-plates regular; oval heart-shape, with the point inward; outer corners very cleanly curved, outer side nearly straight; length to breadth (ninth plate), $1.2 : 2.2$. Near tip of arm, the plates are regular heart-shape, with an acute point turned inward. Grains of disk elongated so as to form short spines, like grains of wheat, of different sizes; about 25 to a square mm .; of the same character below, but less numerous; a bare strip running along edges of genital slits. Arm-spines five, robust, rounded, somewhat flattened, a little tapering, blunt; the longer ones sometimes bent; third spine from the top longest; the longest spines are near the twentieth joint; lengths to that of under arm-plate (eighteenth joint), $2, 2.2, 2.7, 1.8, 1.5 : 1.2$; two lowest spines more slender than the upper ones. Sometimes a short supplementary spine above. Longest spine on this specimen, 3.2^{mm} . There are five spines to each joint till close to the tip of the arm, where there are only four. Close to the disk there are commonly six spines, which, however, are a good deal smaller and more even than those beyond. Tentacle-scales large, rounded oval, length to that of under arm-plate, $.5 : 1.2$; on first two or three joints two, on all the rest only one. Color, in alcohol: above, disk uniform gray-brown (Cologne earth and neutral tint); arm-spines and upper arm-plates light yellowish-brown; the former darker at their base;

arms cross-barred with darker bands, from two to four joints on each band; some of the upper arm-plates finely marbled with lighter; below, mouth parts and interbrachial spaces having several shades of brownish yellow; under surface of arms light-brown, a longitudinal brown line runs along the lateral sides of the under arm-plates.

Variations. — The pattern of the color varies little, but the ground tints may have more of yellowish, gray, or brown; it very rarely happens that the arms are not banded. The proportions of arms to disk give such differences as the following: 12 : 65, 15 : 100, 16 : 135, 17.5 : 112. The largest specimen I have seen had a disk of 22^{mm}. Very large specimens have seven spines on some of the joints, and six on most; where there are six spines, it is the fourth that is longest. A young one, with a disk of 3.2^{mm}, had arms of about 22^{mm}; the disk was covered with imbricated scales, with a few large grains; the upper and under arm-plates were similar to those of the adult, but longer; the arm-spines were four, rounded, tapering, and much stouter than those of the adult; the number of mouth-papillæ was the same as in older ones, but there were only two tooth-papillæ. I have seen no young ones with six arms.

O. Alexandri was first received from my friend, Mr. Alex. Agassiz, after whom I have named it. It resembles *O. pumila*, but differs in having the third or fourth arm-spine much longer than the rest.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
300	..	2	Acapulco, Mexico.	.....	Alex. Agassiz.	Alcoholic.
301	1171	5	Cape St. Lucas, Cal.	.....	J. Xantus.	"
<i>Smithsonian Institution.</i>						
1171	..	12+	Cape St. Lucas, Cal.	.....	J. Xantus.	Alcoholic.
1189	..	12+	Cape St. Lucas, Cal.	.....	J. Xantus.	"

Ophiocoma Riisei LÜTKEN.

Ophiocoma Riisei LÜTKEN. Vidensk. Meddelelser. Jan., 1856.

Ophiocoma Riisei LÜTKEN. Addit. ad Hist. Oph., p. 143.

Special Marks. — Arm-spines slender and even; upper one considerably the longest. Mouth-shields ovoid in outline, with the narrow end inward.

Description of a Specimen. — Diameter of disk, 13.4^{mm}; outer edge of mouth-shield to outer corner of opposite mouth-slit, 6^{mm}; greatest breadth of arm without spines, 3^{mm}; length of arm, 63^{mm}; distance from outer edge of mouth-shield to inner point of tooth-papillæ, to that between outer corners of mouth-slits, 2.6 : 2.8; on each side four mouth-papillæ, of which that next the outer one is about twice as broad as the others, which are more pointed and rounded; four irregular horizontal rows of rounded, crowded tooth-papillæ, three in each row, the lowest row on a level with the mouth-papillæ, and consisting of three (sometimes four) papillæ, of which the middle one is the smallest, and all smaller and more flattened than those of the upper rows; four flat, square teeth, projecting beyond the tooth-papillæ. Mouth-shields with an outline nearly like that of an egg, the small end pointing inward; length to greatest breadth, 1.8 : 1.4; the outer end is not evenly rounded, but makes a little projection to form part of the bridge between the inner ends of the genital slits; at their widest part the shields seldom fill the width of the interbrachial spaces. Side mouth-shields triangular, soldered for their whole length to the sides of the mouth-shields, their inner end about on a line with that of the mouth-shield; length to breadth, 1.2 : .8. Basal under arm-plates, and those in middle part of arm, somewhat square, but having six sides, viz.: an outer side, long and curved; an inner, a little re-enteringly curved; two laterals, long, and re-enteringly curved to admit tentacle-scales; and two inner laterals, of about the same length as the inner side. Farther out on arm these sides are less sharply distinguished, the inner laterals becoming merged in the curve of the inner side; and at the tip of arm the plates are elongated, and there are but four sides, an outer and inner, which are curved, and two laterals, which are re-enteringly curved. Length to breadth of plates: second, .6 : .8; third, 1 : 1.2; seventh, 1.2 : 1.6; about two thirds the length of arm, .8 : .8; close to the tip of arm, .6 : .4. Side arm-plates encroach at base of arm, on upper and lower plates, but do not meet above till near the end of arm, and do not meet below except at the very tip. Upper arm-plates pointed oval, but varying in shape; many, though somewhat oval, are angular; first plate rudimen-

tary; for more than half the length of arm, the proportions do not alter much, though the plates grow smaller, but there are such variations among individual plates as 1.2:1.6, 1.2:2; farther out, plates ill defined, very wide and short; length to breadth, .8:1.4; still farther out, plates well defined again, heart-shaped, the point inward; length to breadth, .6:.8. Disk, above, evenly and rather closely granulated with bead-like grains, about sixteen, on the average, to a square *mm.*; underneath, no granulation, except on a small triangular space which is continued from the upper surface; the rest of the interbrachial space covered with fine, obscurely marked scales, about .3^{mm.} long. Arm-spines on second joint two, their lengths to that of the under arm-plate, 1.6, 1.6:1; third joint, three spines, 1.4, 1.8, 1.8:1.2; fifth joint, four spines, 1.8, 1.8, 2, 2.2:1.2; eleventh joint, four spines, 4.8, 4.4, 4.4, 4.4:1.2; about two thirds the length of the arm, 3.4, 2.8, 2.2, 2.2:.8; close to tip of arm, three spines, .8, .6, .6:.6. From near the disk to about two thirds the length of the arm, there are sometimes four, sometimes three spines to each joint, these numbers often alternating; on the joints not enclosed by the disk, the upper spine is generally much the longest, and is more rounded, particularly on those joints that have as many as four spines, while the remaining two or three are nearly equal. The characteristic upper spine is slender, pretty even, nearly cylindrical, with a thickness to length as .8:4.8. Tentacle-scales, two on first pair of pores, and rarely on second pair; on all the rest, only one; in shape regular oval; length of those on third joint, to length of under arm-plate, .6:1.2. Color, in alcohol: roof of disk brown (Cologne earth), with obscure radiating bands of darker; interbrachial spaces lighter; under arm-plates uniform light-brown; chewing apparatus and mouth-shields still lighter; upper arm-plates brown, with occasionally some much darker, thus making cross stripes. Uppermost arm-spines mottled with lighter and darker brown; lower spines like under arm-plates; tentacle-scales like under arm-plates.

Variations.— This species is common in the West Indies, though not so much so as *O. echinata*, which lives side by side with it. The disk often attains a size of 24^{mm.}, with arms five or six times as long, and the longest upper arm-spines 10^{mm.}. The color in full-grown specimens is singularly invariable; the arm-spines may be more or less inclined to reddish or to umber brown. Small specimens often have the back of the disk ornamented with a star, of dark brown, made up of two radiating lines in each brachial space. The granulation of the interbrachial spaces below may be more or less perfect.

O. Riisei may be distinguished from *O. echinata* by the different shapes of mouth-shields and upper arm-spines; and from *O. aethiops* by much narrower upper arm-plates.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
276	..	12+	Florida.	.....	Prof. Agassiz.	Alcoholic.
277	..	1	Bay of Cumana.	.....	Capt. Coethouy.	"
278	..	3	Key West, Fla.	Feb. 1856.	T. Lyman.	"
279	..	4	Tortugas, Fla.	Mar. 13, '58.	J. E. Mills.	"
280	..	4	Key West, Fla.	Mar. 6, 1858.	J. E. Mills.	"
281	..	1	Tortugas, Fla.	Apr. 14, 1858.	J. E. Mills.	"
282	..	1	Cape Florida.	Apr. 1858.	J. E. Mills and G. Wurdeman.	"
283	..	2	Florida.	.....	Prof. Agassiz.	"
284	..	3	Cape Florida.	.....	G. Wurdeman.	"
285	..	9	Jeremie, Hayti.	1858.	Dr. D. F. Weinland.	"
286	..	3	St. Thomas, W. I.	.....	A. H. Riise.	"
287	..	12	Tortugas, Fla.	Mh. 13-19, '58.	J. E. Mills.	"
288	61	1	West Indies.	.....	University Museum, Copenhagen.	"
289	..	12+	Florida.	.....	G. Wurdeman.	Dried.
290	..	12+	Florida?	.....	.....	"
365	Key West, Fla.	.....	Dr. Holder.	Alcoholic.
<i>Smithsonian Institution.</i>						
1100	..	2	St. Thomas, W. I.	.....	A. H. Riise.	Alcoholic.
998	..	12+	Florida Keys.	.....	.....	"
1000	..	7	Tortugas, Fla.	Mh. 18, '58.	.....	"
1176	..	3	Tortugas, Fla.	.....	Dr. Whitehurst.	"
1089	..	1	St. Thomas, W. I.	.....	A. H. Riise.	Dried.

Ophiocoma æthiops LÜTKEN.*Ophiocoma æthiops* LÜTKEN. Addit. ad Hist. Oph., p. 145.

Special Marks. — Large species. Greatest width of arms more than three times as great as the length of the under arm-plates. Upper arm-spine thickened.

Description of a Specimen. — Diameter of disk, 31^{mm}; outer edge of mouth-shield to outer corner of opposite mouth-slit, 13^{mm}; greatest width of arm without spines, 7^{mm}; length of arm, 190^{mm}; distance from outer edge of mouth-shield to inner points of tooth-papillæ, to that between outer corners of mouth-slits, 5.6 : 6.3. Eight broad, rounded mouth-papillæ to each angle of mouth; of these the one next the outer one usually broadest; besides these, a row of three or four minute bead-like mouth-papillæ, just below and outside of the tooth-papillæ, with which they might properly be classed. Tooth-papillæ about eighteen, irregularly disposed, short, stout, rounded, the two or three lowest bead-like and much smaller than the rest. Teeth four, shaped

like flattened, rounded wedges, somewhat narrower within than without. Mouth-shields oblong, with rounded corners; length to breadth, 4:3. Side mouth-shields small, rather variable in size, triangular; length to breadth, 1.5:1. Under arm-plates squarish; third, fourth, fifth, and sixth plates of nearly equal size, and smaller than those beyond, their lateral sides nearly straight, their outer and inner sides a little curved, length to breadth, 2:2; seventeenth plate typical in shape, outer side slightly curved, lateral sides straight, and sloping a little inward and towards each other, inner side making rather a strong curve; length to breadth, 2.3:2.3; about two thirds out on arm, plates almost square, with straight sides, and corners a little rounded, length to breadth, 1.7:1.7; close to tip of arm, plates twice as long as broad, elongated oval, broader without than within. Side arm-plates encroaching on upper and lower arm-plates, sometimes nearly meeting below, and thus slightly separating two neighboring plates; they do not properly meet above and below till close to tip of arm. Upper arm-plates much broader than long, shaped like a narrow oval, with pointed corners; near base of arm, length to breadth, in broader ones, 2.2:6.5; in narrower ones, 2.2:5. First plate rudimentary, very short and narrow, partly covered by granulation of disk; second, third, and fourth plates rather narrower than those just beyond, and often stouter, so that the arm looks constricted at its base. The plates maintain the same general shape and proportions till close to tip of arm. Granulation of disk close, fine, and bead-like, both above and below; near base of arms above, coarser and more scattered; about 30 grains to a square *mm.* where granulation is thickest; below, granulation reaches nearly, or quite, to edges of genital slits. Arm-spines stout, rounded, somewhat flattened, the lowest ones most so, increasing in thickness from below above; near base of arm, usually four. Second, third, and fourth joints each with three small, very flat spines, lowest one usually longest, sometimes 2^{mm.}; on next three or four joints, spines grow more rounded and tapering, in number three, four, or rarely five; on seventeenth joint, typical spines, lengths to that of under arm-plate, 5, 4.5, 4, 4:2.3; beyond this, joints with three and with four spines usually alternate till a point about three fourths the length of the arm, after which there are only three slender, rounded, tapering spines, of nearly equal length and thickness. Tentacle-scales nearly regular oval, a little pointed without, rather thick, length to that of under arm-plate, 1:2.3; only one on each pore, except pores of second joint, and a few others scattered, which have two. Color, in alcohol: above, dark, rich vandyke-brown, disk irregularly and obscurely radiated with darker and lighter; below, interbranchial spaces uniform brown; rest same color, but considerably lighter.

Variations.—In other specimens the disk was to the arms as 29:145, 32:162, 10.5:56. Tentacle-scales vary much in number on specimens of same size, and even on same individual; occasionally there are regularly two scales to each pore as far out as the thirty-third joint, but this is unusual. Tooth-papillæ commonly arranged in five regular horizontal rows, of three each. Granulation of disk does not always cover whole of interbrachial spaces below, but a broad band may be left running along the genital slits, and outside the mouth-shield. Color varies to a certain extent. It may be even dirty white, blotched with dark brown, on the upper side of the disk, with lower side of arms very light brown, the lower arm-plates being more or less mottled; extremities of arms may be banded with darker and lighter. A young one having a disk of 10.5^{mm}. was similar to the larger specimens, but had the arms banded for their whole length, the arm-plates speckled with lighter, the mouth-papillæ regular and bead-like, and the tooth-papillæ in horizontal rows of only two each.

This species is distinguished from *O. echinata* and *O. Riisei* by wider and flatter arms, and by differently shaped arm-spines and mouth-shields.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
302	..	12+	Acapulco, Mexico.	.....	Alex. Agassiz.	Alcoholic.
303	..	12+	Panama.	.....	Alex. Agassiz.	"
304	..	7	Panama.	.....	Alex. Agassiz.	"
305	1170 & 1190	3	Cape St. Lucas, Cal.	.....	J. Xantus.	"
<i>Smithsonian Institution.</i>						
1007	..	4	Panama.	.....	Dr. Sternbergh.	Alcoholic.
1008	..	4	Panama.	.....	Rev. T. Powell.	"
1011	..	1	Panama.	.....	Dr. Suckley.	"
1185	..	4	West Coast Nicaragua.	.....	Capt. Dow.	Dried.
1170	..	12+	Cape St. Lucas, Cal.	.....	J. Xantus.	Alcoholic.
1190	..	5	Cape St. Lucas, Cal.	.....	J. Xantus.	"

Ophiocoma nigra MÜLL. & TROSCH.

Asterias nigra O. F. MÜLL. Zoöl. Dan., Pl. XCH.

Ophiocoma granulata FORBES (non Linck.). Brit. Starfishes, p. 50.

Ophiocoma nigra MÜLL. & TROSCH. System der Asteriden, p. 100.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
308	..	3	Greenland.	.....	Prof. Sars, 1852.	Alcoholic.
309	..	1	Norway.	.....	University Museum, Copenhagen.	"

Ophiocoma echinata AGASS. (Fig. 5.)

Ophiura echinata LAMK. Hist. An. sans Vertèb., II. p. 540. 1816.

Ophiocoma echinata AGASS. Prodrome. Mém. Soc. Scien. Nat. de Neuchatel, I. 1835.

Ophiura crassispina SAY. Journ. Phil. Acad., V. p. 147. 1825.

Ophiocoma crassispina MÜLL. & TROSCH. Syst. Asterid., p. 103.

Ophiocoma serpentaria MÜLL. & TROSCH. Syst. Asterid., p. 98.

Ophiocoma crassispina LÜTKEN. Addit. ad Hist. Oph., p. 142.

Special Marks. — Upper arm-spine much thickened; mouth-shields nearly square, with rounded corners.

Description of a Specimen. — Diameter of disk, 23.6^{mm}; from outer edge of mouth-shield to outer corner of opposite mouth-slit, 9.4^{mm}; greatest width of arm without spines, 4^{mm}; length of arm, 100^{mm}; distance from outer edge of mouth-shield to points of tooth-papillæ, to that between outer corners of the mouth-slits as 2:2.6. On each side of the mouth-frames four mouth-papillæ, of which the three outer ones have their grinding edge bevelled, which makes the outer edge shorter than the inner one; the innermost papilla points towards the centre of the mouth, and is stout and more conical than the others; the other three are also stout, but are more flattened; their corners and edges are rounded. On the jaw, four irregular, horizontal rows of stout, rounded, close-set tooth-papillæ, three in each row; the lowest row is on a level with the line of the mouth-papillæ, and the tooth-papillæ of this row are smaller than the rest, and moreover may vary in number, being some-



Fig. 5.
Ophiocoma echinata.
Chewing apparatus,
seen from within.
d, tooth-papillæ;
d', teeth.

times only two, or again four; and in addition there is sometimes another very small papilla below and outside this row. Teeth four, their inner ends nearly square, upper one more tapering and rounded. Mouth-shields a little longer than broad, squarish, with rounded corners; length to breadth, 2.6 : 2. Side mouth-shields small, like elongated triangles, lying close to, and soldered with, the sides of the mouth-shields, their inner ends nearly on a line with those of the mouth-shields. The general shape of the under arm-plates at the base of the arm, and so outwards nearly to the tip, is square; lengths to breadths as follows: second plate, 1.4 : 1.4; sixth plate, 1.4 : 1.8; about two thirds the length of the arm, 1.2 : 1.6; plates on the tip joint, .8 : .6. The plates have really six sides, of which the inner and outer ones are parallel to each other, and are straight; the inner lateral sides are slightly re-entering curves, the outer lateral sides are straight and short. In the sixth plate the proportions of the sides are as follows: inner, 1.6; outer, 1; inner lateral, 1; outer lateral, .6. The rest of the plates for some distance along the arm do not materially differ from the sixth plate in their proportions. The first under arm-plate bounds the outer corner of the mouth-slit, and is very small; it is somewhat heart-shaped, the length to breadth as 1 : .8. Side arm-plates thick and stout, covered up by a thick skin, except a triangular piece, which fills the space between the base of the upper arm-spine, and the angle formed by the corners of the nearest pair of upper arm-plates. Towards the tip of the arm the side plates are better seen, having a thinner skin over them; also, as is usual, they encroach more and more on the upper and lower plates; at the tip of the arm they meet above and below. Upper arm-plates vary somewhat in size and in their outlines; the general form is oval, with pointed ends; each overlaps a little the next outer one, less, however, at the tip of the arm, than nearer its base; the innermost plate is rudimentary; length of the sixth plate to breadth as 1.6 : 3; close to the tip of the arm the plates are heart-shaped, with the point turned inward, the length being to the breadth as .6 : .8; for at least three fourths the length of the arm, though the plates gradually grow smaller, the average proportions of length to breadth among them remain about the same, but single plates vary so as to give such differences as 1.6 : 2.6, 1.6 : 3.8; the variable diameter is the breadth. Disk, above, evenly and rather closely granulated, with smooth, bead-like grains, about 25, on the average, to a square *mm.*; below, the interbrachial spaces have a band on each side, running parallel to the genital slits, which is without grains, and shows the under coat of small, thin, overlapping scales, the largest of them about .1^{mm.} long; in the midst of the interbrachial spaces the granulation is as above, except near the mouth-shields, where the grains are few and scattered. The genital slits have, near the mouth-shields, a raised granulated ridge

running along their edge; their inner ends are separated by a bridge of about one half the width of the mouth-shields. Arm-spines of moderate length, and two upper ones quite stout. Second joint three spines, small and flattened, with rounded ends; lengths to that of lower arm-plate: upper, .8 : 1.8; lowest, 1.8 : 1.8; middle, 1.2 : 1.8; third and fourth joints have three spines; the fifth, and those immediately beyond, four. Five spines on each side are rare; at about one fourth the length of the arm there again begin to appear only three spines, and joints bearing this number often alternate with those having four; still farther out, as many as four spines become rare, and near the tip of the arm there are only three. Fifteenth joint four spines, lengths to that of under arm-plate, 3.6, 3.2, 2.4, 2.4 : 1.6; the upper spine is much the largest; it is rounded, slightly curved, flattened, and tapering, and is very stout; its greatest thickness to its length as 1.2 : 3.6; the next lower is of about the same proportions, but somewhat less stout; the two lowest are more tapering, and much more flattened. These four may be considered the characteristic spines of the species; the upper spine is the most variable, and may have a proportionate length as great as 4.2; as they approach the end of the arm, the spines become proportionately longer, more slender, and less flattened; lengths to that of under arm-plate, 3, 1.6, 1.8 : 1.2; the two lower ones are still much flattened, but the upper one is nearly cylindrical, and varies in length from 2.4 to 3.6; at the tip of the arm the upper spine has quite lost its stout, blunt character, and has become very slender; the lengths of spines to that of under arm-plate, 1.4, 1.2, 1.2 : .8. There are two tentacle-scales to each pore, and this number continues for about three fourths the length of the arm, when pores with only one scale begin to appear; sometimes there will be several such, followed by several more, each with two scales, but the last joints have but one scale to each pore; near the disk their length is to their breadth as 1 : .4, they are much flattened, widest near the top, somewhat contracted at the base; the inner is usually a trifle the longer; they stand close, side by side. Color, in alcohol: roof of the disk light brown, mixed with some light-brownish gray, and ten indistinct radiating lines of the latter color; below, interbrachial spaces similarly colored, but the edges of the genital slits are nearly white; the ground color of the mouth-papillæ, side mouth-shields, and mouth-shields, is nearly white, but they are more or less clouded with light brown; the under arm-plates, for one fourth or one third the length of the arm, are whitish, with a large spot of brown; farther out the plates are entirely brown. The side arm-plates are yellowish, finely mottled with light brown. The upper arm-plates are purplish brown, with one, two, or three plates at varying distances, much lighter colored, thus giving an irregular barred appearance. The upper and second arm-spines are light purplish-brown, their points and

sides marked with lighter; near the tip of the arm they are somewhat lighter colored; third and fourth arm-spines pure white below, above white, with a broad central line of purplish brown; tentacle-scales white, with small purplish-brown spots, of which one is almost always at the base of the scale.

Variations.—The color, though varying in intensity, is usually as described above; sometimes, however, the upper surface of the disk bears large patches of light grayish; and, again, the whole animal may be light gray, variously marked and clouded with brown; this pattern is seldom seen, except in the young. The granulation of the interbranchial spaces below differs; sometimes it completely covers the whole area; at other times, particularly among the young, it is confined to a small triangular patch in the centre. A young one, with a disk of 9^{mm}, had arms 47^{mm} long; the under arm-plates were a good deal broader without than within, the outer side being strongly curved, and the laterals re-enteringly curved; the disk granulation was only partial below, but perfect above, with about 90 grains to a square *mm*.; there were only three rows of tooth-papillæ.

O. echinata is the commonest of the West Indian Ophiuridæ. It has been found from low-water-mark to four fathoms; usually on corals, but often, also, on *Gorgonia flabellum*. The color does not change in alcohol. The species is distinguished from *O. Riisei* by the shape of the upper arm-spine and of the mouth-shields, and from *O. æthiops* by much narrower upper arm-plates.

Müller & Troschel state that Lamarck confounded several species under the name of *echinata*, and among them a specimen from the Antilles, brought by Plée, and which they make the type of their *O. serpentaria*. They exclude *O. echinata* entirely, without any reason at all. The real original of Lamarck is a dried specimen in the Jardin des Plantes, which, as I satisfied myself, was brought by Maugé from Porto Rico in 1799. This is no other than the *Ophiura crassispina* afterwards described by Say, and identical also with Plée's specimen above mentioned.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
256	..	9	Bay of Cumana.	.....	Capt. Couthouy.	Alcoholic.
257	..	8	Florida.	.....	Prof. Agassiz.	"
258	..	7	Cape Florida.	Apr. 1858.	J. E. Mills and G. Wurdeman.	"
259	..	4	Florida ?	.....	Prof. Agassiz.	"
260	..	12+	Tortugas, Fla.	Mch. 1858.	J. E. Mills.	"
261	..	3	Tortugas, Fla.	Feb. 1856.	T. Lyman.	"
262	..	6	Tortugas, Fla.	Ap. 24, 1858.	J. E. Mills.	"
263	..	3	Hayti.	.....	E. Habich.	"
264	..	5	Tortugas, Fla.	Mh. 15, 1858.	J. E. Mills.	"
265	..	1	Hayti.	1858.	Dr. D. F. Weinland.	"
266	..	1	Key West, Fla.	Mh. 6, 1856.	J. E. Mills.	"
267	..	12+	Jeremie, Hayti.	1858.	Dr. D. F. Weinland.	"
268	..	2	St. Thomas, W. I.	.....	A. H. Riise.	"
269	..	5	Florida.	.....	G. Wurdeman.	"
270	..	2	Florida.	.....	Prof. Agassiz.	"
271	63*	4	West Indies.	.....	University Museum, Copenhagen.	"
272	63*	2	West Indies.	.....	" "	"
273	141, 142	12+	Tortugas, Fla.	Mh. 4-19, '58.	J. E. Mills.	"
274	..	12+	Florida.	.....	G. Wurdeman.	Dried.
275	..	12+	Florida ?	.....	.....	"
358	Florida.	.....	S. H. Scudder.	Alcoholic.
<i>Smithsonian Institution.</i>						
996	..	12+	Tortugas, Fla.	.....	.....	Alcoholic.
997	..	12+	Florida Keys.	.....	.....	"
987	..	6	Tortugas, Fla.	.....	Dr. Whitehurst.	"
990	..	4	Cape Florida.	May, 1858.	G. Wurdeman.	"
999	..	12+	Tortugas, Fla.	Mh. 18, 1858.	.....	"
984	..	6	Tortugas, Fla.	.....	Capt. Woodbury.	"
985	..	1	Cape Florida.	.....	G. Wurdeman.	"
1018	..	1	West Indies.	.....	University Museum, Copenhagen.	"
1004	..	2	Aspinwall.	.....	Rev. T. Powell.	"
1101	..	2	St. Thomas, W. I.	.....	A. H. Riise.	"
1077	..	4	St. Thomas, W. I.	.....	A. H. Riise.	Dried.

Ophiocoma erinaceus MÜLL. & TROSCH.

Ophiocoma erinaceus MÜLL. & TROSCH. Syst. Asteriden, p. 98.

Ophiocoma tartarea LYMAN. Proceed. Boston Soc. Nat. Hist., VIII. p. 78.

Ophiocoma erinaceus LÜTKEN. Addit. ad Hist. Oph., p. 164.

Special Marks. — Black or dark brown; arms from three and a half to five and a half times as long as diameter of disk; two tentacle-scales; interbranchial spaces below not granulated.

Description of a Specimen. — Diameter of disk, 25^{mm.}; breadth of arm without spines, 4^{mm.}; length of arm, 132^{mm.}; tooth-papillæ fourteen to eighteen, sometimes in transverse rows of three, sometimes irregularly

placed. Teeth stout, thickened, four in number. Mouth-shields longer than broad, broader without than within, corners all rounded; outer side curved, or made up of three lines; lateral sides re-enteringly curved; length to breadth, 3.3:2.8. Side mouth-shields triangular, small, broad, lying entirely on the sides of the mouth-shields. Under arm-plates considerably broader than long; a little way from the disk, regularly hexagonal; length to breadth (fourteenth plate), 1.9:2.5. Upper arm-plates broader than long, somewhat affected in shape by the number of arm-spines; most are either hexagonal or oval hexagonal, with very sharp lateral corners; length to breadth (thirteenth plate), 1.9:4.2. Disk very regularly and finely granulated above, about 14 to a square *mm.*; below, interbrachial spaces naked, showing the fine scales. Arm-spines, near base of arm, alternating five and four, rarely six; farther out, four and three; at the tip of the arm only three; upper spine very long, slender, cylindrical, slightly tapering, sometimes a little curved; other spines smaller; within the disk the lowest spine is often much flattened and widened at its end; lengths to that of under arm-plate, 9, 6.8, 5.5, 5.5, 3.5, 3.5:1.9. Tentacle-scales two, nearly to the tip of the arm; outside one oval, inside one more or less irregular. Color, in alcohol, black, the under surface of the arms having a brownish shade.

Variations. — This species presents, with a wide geographical range, a considerable variation in the length of the arms, and in the length and stoutness of the arm-spines. As a rule (not, however, absolute), specimens from the Pacific Islands have longer and more slender arms and arm-spines. It is this variety that I described as *O. tartarea*. The original description of Müller is insufficient.

The specimen above described had spines of the maximum length. Another large specimen, with a disk of 27^{mm.} and arms of 150^{mm.}, had the spines as follows: 6, 5.5, 4, 3.3, 2.7. The spines of another were 5.8, 4.5, 3.5, 2.8, 2.5, the disk being 22^{mm.}. A partly grown specimen from Kingsmills Islands belonged apparently to this species; the disk was 20^{mm.} in diameter, and the spines were 5, 3, 2.6, 2.6, 2.6. A specimen in the Jardin des Plantes, from the Iles Seychelles, had a disk of 31^{mm.}, and the arm 98^{mm.}; the spines being 6, 3.8, 3.8, 3.2. The upper spine was swollen, as in *O. echinata*; the three lower ones flattened, and cut short off at the end. The color was nearly black. I have seen a large specimen from Zanzibar, whose disk had a diameter of 30^{mm.}, while the longest arm-spine was only 4.6^{mm.}. There were only four spines, except, perhaps, at the very base of the arm.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
307	..	6	Zanzibar.	.....	Mr. Cheney.	Alcoholic.
312	..	3	Sandwich Islands.	.....	A. Garrett.	"
313	..	4	Sandwich Islands.	.....	A. Garrett.	"
314	26 & 28	2	Sandwich Islands.	.....	A. Garrett.	Dried.
315	..	9	Kingsmills Islands.	.....	A. Garrett.	Alcoholic.
316	..	3	Kingsmills Islands.	.....	A. Garrett.	Dried.
366	Zanzibar.	.....	E. Ropes.	Alcoholic.
368	Zanzibar.	.....	Capt. Webb.	"
369	Zanzibar?	.....	Salem Normal School.	"
370	Mozambique.	.....	C. Cooke.	"
367	Society Islands.	.....	A. Garrett.	"
431	Iles Seychelles.	.....	Jardin des Plantes.	"

Ophiocoma scolopendrina AGASS.

Ophiura scolopendrina LAMK. Hist. An. sans Vertèb., II. p. 544.

Ophiocoma scolopendrina AGASS. Prodrome. Mém. Soc. Scien. Nat. Neuchatel, I. 1835.

Ophiocoma scolopendrina LÜTKEN. Additamenta ad Hist. Oph., p. 163.

Ophiocoma molaris LYMAN. Proceed. Boston Soc. Nat. Hist., VIII. p. 79.

Special Marks.—Arms five and a half to eight times the diameter of the disk. Spines ringed with darker and lighter; upper one longest. Granulation of disk even, and rather fine. Color, grayish or mottled.

Description of a Specimen.—Diameter of disk, 24^{mm.}; width of arm without spines, 4^{mm.}; length of arm, 137^{mm.}. Mouth-papillæ eleven or twelve, the innermost two much the smallest. Tooth-papillæ seven or eight, rather large. Teeth four, upper one narrowest and sharpest. Mouth-shields longer than broad, much narrower within than without, pretty regular; bounded without by a curve, within and on the sides by straight lines; length to breadth, 2.6:2. Side mouth-shields small, triangular, lying on the sides of the mouth-shields. Under arm-plates rather broader than long, hexagonal, the outer side and outer laterals being more conspicuous than the corresponding sides within; length to breadth (tenth plate), 1.5:2. Upper arm-plates broader than long, quite irregular, varying in breadth according to the encroachment of the upper arm-spines; oval, with pointed lateral corners; length to breadth (seventh plate), 1.5:3.4. Disk regularly, but rather loosely granulated, 20 to a square mm.; below, interbrachial spaces granulated, except a band along each genital slit. Arm-spines near base of arm, alternating four and three, slender, elegant, little tapering, somewhat

flattened; upper one longest and largest, but never *swelled*; lengths to that of under arm-plate, 5.5, 3.5, 2.5, 2:1.5. Tentacle-scales two on base of arm, but a little way out only one. Color, in alcohol: above, umber brown; below, interbrachial spaces the same, the other parts lighter; some of the arm-spines ringed with lighter.

Variations. — The same variations, as to the length of the arms, and the length and stoutness of the arm-spines, exist in this wide-ranging species, as in *O. erinaceus*; and the parallel is further carried out by the fact that the specimens from the east coast of Africa have commonly, though not always, shorter arms and stouter spines than those from the Pacific Islands. The latter variety I have described as *O. molaris*.

The arms vary from five and a half to eight times the diameter of the disk. The tooth-papillæ are commonly about nine, rarely twelve. The color varies in depth; the lightest specimens are pale bluish-gray, varied with specks and marblings of white; below, nearly white, with brown lines round the under arm-plates. The lighter the color, the more conspicuous are the dark rings round the spines. The number of joints furnished with two tentacle-scales varies somewhat, often differing on the different arms of the same individual. A specimen with a disk of 23^{mm}. had arms of 161^{mm}.; length of arm-spines to under arm-plate, 4.5, 4, 3, 2.5:1.4. A small specimen had the disk 14^{mm}, arms 110; arm-spines to under arm-plate, 4, 2.5, 2, 1.6:1.1. The original *Ophiura scolopendrina* of Lamarck is a dried specimen, from the Ile de France, and now in the Jardin des Plantes. The disk is 27^{mm}. in diameter; arm, 175^{mm}. long; upper arm-spine, 3.5^{mm}. long, somewhat swelled, ringed with white and brown. The disk yellowish brown; arms mottled, light grayish-brown and dirty white. Arm-spines three or four, the three lowest much more slender, and somewhat shorter, than the upper.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
324	..	12+	Kingsmills Islands.	.....	A. Garrett.	Alcoholic.
325	..	3	Kingsmills Islands.	.....	A. Garrett.	Dried.
432	New Guinea.	.....	Jardin des Plantes.	Alcoholic.
360	Zanzibar.	.....	Capt. Ashby.	"
361	Zanzibar.	.....	C. Cooke.	"
362	"
363	Mozambique.	.....	C. Cooke.	"
364	Arabian Gulf.	.....	Capt. Millet.	"

Ophiocoma insularia LYMAN.

Ophiocoma insularia LYMAN. Proceed. Boston Soc. Nat. Hist., VIII. p. 80.

Special Marks. — Lower spines longer than the upper; arms flat, about four times as long as diameter of disk; under arm-plates regular, and about as long as broad; interbrachial spaces below closely granulated.

Description of a Specimen. — Diameter of disk, 30^{mm}; width of arm without spines, 4.5^{mm}; length of arm, 125^{mm}. Mouth-papillæ, six on each side; under the teeth there cannot be said to be any mouth-papillæ, because the tooth-papillæ, which sometimes are as many as twenty, extend downwards and outwards, growing smaller and smaller, till they nearly reach the inner end of the mouth-shield. Teeth four, flat and squarish, upper one smallest. Mouth-shields about as long as broad, much rounded, without straight lines; length to breadth, 2.8:2.5. Side mouth-shields small, triangular, lying entirely on the sides of the mouth-shields. Under arm-plates about as broad as long, bounded without by a curve, and within by a short inner side and two inner laterals; length to breadth (sixteenth plate), 2:2. Upper arm-plates even and regular, much broader than long, bounded without by a clean curve, and within by an inner side and two inner laterals; length to breadth, 2:4. Granulation of the disk extremely close and fine above and below, and extending even to the outer corner of the side mouth-shields; about 45 to a square *mm*. Arm-spines rather short, little tapering, blunt, a good deal compressed; on the first few joints beyond the disk, four, very rarely indeed five; farther out, three; they do not alternate three and four, as is seen in many other species; lengths to that of under arm-plate, 3, 3.1, 3.6, 3.5:2. Tentacle-scales two, large and regular, much longer than broad. Color, in alcohol: above, deep umber, almost black; below, interbrachial spaces the same; arms a little lighter.

Variations. — A young specimen, with a disk of 9.5^{mm}, had arms 35^{mm} long; the mouth-shields were narrower than in the adult, the color was paler, and the tips of the arms were cross-barred with white. A very large specimen, with a disk 33^{mm} in diameter, had arms 155^{mm} long; the proportion of the arm-spines to the under arm-plate was 3.5, 3.5, 3.7, 3.7:2; the upper spines were greatly flattened, and were cut square off at the end. Some well-grown individuals have cross-bars of light-brown towards the end of the arm.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
317	..	3	Sandwich Islands.	.....	A. Garrett.	Alcoholic.
318	..	7	Sandwich Islands.	.....	A. Garrett.	"
319	..	12+	Sandwich Islands.	.....	A. Garrett.	"
320	..	1	Sandwich Islands.	.....	A. Garrett.	Dried.

Ophiocoma pica MÜLL. & TROSCH.

Ophiocoma pica MÜLL. & TROSCH. Syst. Asteriden, p. 101.

Ophiocoma lineolata MÜLL. & TROSCH. Syst. Asteriden, p. 102.

Ophiocoma sannio LYMAN. Proceed. Boston Soc. Nat. Hist., VIII. p. 81.

Special Marks.—Arms to disk as four to one; they are banded with yellowish. Six arm-spines in the adult, slender and elegant; upper ones longest, and as long as the combined lengths of three and a half to four and a half under arm-plates.

Description of a Specimen.—Diameter of disk, 27^{mm.}; width of arm without spines, 4^{mm.}; length of arm about 90^{mm.}. Mouth-papillæ six; three on each side. Tooth-papillæ irregularly placed, extending nearly to the inner end of the mouth-shield, the lowest ones smallest; about twenty-one in number. Teeth five, lowest one very small, and nearly surrounded by papillæ; upper one small, and somewhat pointed. Mouth-shields oval, longer than broad; length to breadth, 2.5 : 2. Under arm-plates broader than long, regular, bounded without and within by a curve, on the sides by re-entering curves; length to breadth (tenth plate), 1.4 : 2. Upper arm-plates very regular, bounded without by a clean curve, nearly oval, but flattened a little within; length to breadth (tenth plate), 1.4 : 2.4. Disk, above and on the sides, finely and closely granulated, about 45 grains to a square *mm.*, brachial spaces below naked; showing unusually large scales, having a diameter of .5^{mm.}. Arm-spines six, remarkably slender, tapering, and regular; lengths to that of under arm-plate, 5.2, 6, 5, 4.2, 3.8, 3.2 : 1.4. Tentacle-scales two, rather large and pointed. Color, in alcohol: above, very dark purplish-brown; the disk ornamented with numerous fine radiating lines of yellowish; two yellowish specks at the base of each arm; about every other upper arm-plate is cross-barred with yellowish, the base of the upper spine having the same color; below, interbrachial

spaces dark brown, varied with yellowish; yellowish spots between the under arm-plates.

Variations. — The arrangement of colors on the disk varies; sometimes the disk is wholly dark, or, again, only spotted with light yellowish; but the arms are always more or less banded with light. A light mark on each side of the mouth-shield is very characteristic. A young specimen, with a disk of 9^{mm}, had arms 34^{mm} long; there were five arm-spines. Another had four, and close to the disk five arm-spines; the disk was to the arms as 6:21. In younger specimens the tooth-papillæ are of course fewer.

Müller & Troschel made the singular mistake of describing this strongly marked species under two names, *O. pica* and *O. lineolata*. Both descriptions are inaccurate; so much so that I described it under a *third* name, *O. sannio*. A glance at the originals in the Jardin des Plantes and the Berlin Museum, was enough to remove all error. The originals of *O. pica*, in Paris, are dried, and about half grown. Disk, 15^{mm}; arm, 50^{mm}; five arm-spines, of which the upper is 3.2^{mm} long. The original of *O. lineolata* (Berlin Zoöl. Mus., No. 951) is also not quite fully grown. The disk is 18^{mm} in diameter; arm, 58^{mm} long; five rows of spines, whereof the upper and middle ones are longest. The specimens are dried, and are from Aden on the Red Sea.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
321	..	1	Sandwich Islands.	.....	A. Garrett.	Alcoholic.
322	..	12+	Sandwich Islands.	.....	A. Garrett.	"
323	27	1	Sandwich Islands.	.....	A. Garrett.	Dried.
332	..	1	Kingsmills Islands.	.....	A. Garrett.	Alcoholic.
333	..	1	Sandwich Islands.	.....	A. Garrett.	"
433	Java.	.....	Jardin des Plantes.	"
355	Society Islands.	.....	A. Garrett.	"

Ophiocoma brevipes PETERS.*Ophiocoma brevipes* PETERS. Wiegmann's Archiv., p. 84. 1852.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
310	..	7	Kingsmills Islands.	.....	A. Garrett.	Alcoholic.

OPHIOMASTIX MÜLL. & TROSCH.**Ophiomastix venosa** PETERS. Wiegmann's Archiv. fur Naturg., p. 84. 1852.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
255	..	10	Zanzibar.	.....	G. A. Cheney.	Alcoholic.
398	Zanzibar.	.....	Capt. Webb.	"
399	Zanzibar.	.....	C. Cooke.	"

OPHIARTHURUM PETERS.**Ophiarthrum elegans** PETERS. Wiegmann's Archiv., p. 84. 1852.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
371	Zanzibar.	.....	C. Cooke.	Alcoholic.
372	Society Islands.	.....	A. Garrett.	"

OPHIACANTHA MÜLL. & TROSCH.

TYPE OF THE GENUS, *O. spinulosa* Müll. & Trosch.

Disk with little thorny spines. Radial shields covered. Teeth; mouth-papillæ; no tooth-papillæ. Spines numerous, slender, minutely thorny; arranged on the sides of the side arm-plates. Side arm-plates meeting nearly, or quite, above and below. Two genital slits, beginning outside the mouth-shields.

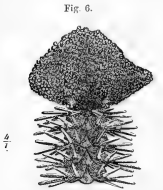
SPECIES HEREIN DESCRIBED.

*O. spinulosa.**O. setosa.***Ophiacantha spinulosa** MÜLL. & TROSCH. (Figs. 6, 7.)*Ophiacantha spinulosa* MÜLL. & TROSCH. Syst. Asteriden, p. 107.*Ophiocoma arctica* MÜLL. & TROSCH. Syst. Asteriden, p. 103.*Ophiacantha grønlandica* MÜLL. & TROSCH. Wieg. Archiv. für Naturg., p. 183. 1844.*Ophiocoma echinulata* FORBES. Sutherland's Journal. Appendix.*Ophiacantha spinulosa* LÜTKEN. Addit. ad Hist. Oph., p. 65.

Special Marks. — Disk evenly covered with short spines.

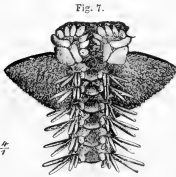
Description of a Specimen. — Diameter of disk, 9.5^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 5^{mm}; width of arm without spines, 1.7^{mm}; length of arm, 42^{mm}; distance from outer side of mouth-shield to inner points of teeth, to that between outer corners of mouth-slits, 2.1:2.6. Mouth-papillæ, six or seven to each angle of mouth; standing well apart; two outermost on each side small, flattened, somewhat rounded, blunt; innermost one sharp, rounded, conical, resembling the lowest tooth, which also might well enough be considered as a mouth-papilla. Teeth seven, thin, rather long, flat, with a rounded cutting edge; lowest one narrowest; uppermost one split in two. Mouth-shields much broader than long; outer side curved, lateral ends pointed; a rounded peak within; length to breadth, .8:1.5. Side mouth-shields meeting within, long, slender, of nearly equal width. Under arm-plates squarish, with an angle within, and their outer corners rounded; separated by side arm-plates; length to breadth (seventh plate), .8:7. First plate broader than long, and about one half as large as those near it; plates close to tip of arm,

small, shield-shaped, with a regular angle inward, their length less than that of the line of juncture of the two side arm-plates. Side arm-plates



Ophiacantha spinulosa. (Upper side.)

large, meeting above and below the whole length of the arm. Upper arm-plates broad triangular, with outer side gently curved, a rounded angle within, and the lateral corners pointed; length to breadth (fifth plate), $7:1.4$; close to tip of arm, the plates are heart-shaped, and very minute, and bear a very small proportion to the side arm-plates, which cover almost the whole surface. Disk evenly and closely covered, above and below, with short, stout cylinders, ending in a rounded crown of



Ophiacantha spinulosa. (Lower side.)

fine thorns; those on the under surface shorter and less thorny; about 20 to a square *mm*. Arm-spines long, slender, slowly tapering, covered with longitudinal rows of microscopic thorns; near the disk eight, farther out seven; lengths to that of under arm-plate (fourth joint), 2, 2, 2, 1.8, 1.5, 1, .8, .8 : .8. One tentacle-scale, longer than broad, rounded at the end; length to that of under arm-plate, .5 : .8. Color, in alcohol: above, light umber; below, paler, except the interbranchial spaces, which are darker.

Variations. — *O. spinulosa* attains the size of 14^{mm}; the disk spines are then less thorny, and are longer than in the young.

This species has been found at Eastport, Maine; and at Grand Manan Island (twenty fathoms, shelly bottom, Stimpson); Newfoundland (Stu-witz); West Greenland (Rudolph, Olick, Hollböhl); Spitzbergen; and on the northwest coast of Norway, from North Cape to the Lofoten Islands, living on corals, nullipores, and ascidia, in from twenty to thirty fathoms (Sars).

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
7	..	3	.....	.....	Prof. Sars.	Alcoholic.
8	..	9	Greenland.	.....	Prof. Sars.	"
9	47	3	Greenland.	.....	University Museum, Copenhagen.	"
10	..	1	Eastport, Me.	July, 1851.	Prof. Agassiz.	"
340	..	3	Straits of Bellisle.	.....	A. S. Packard, Jr.	"
<i>Smithsonian Institution.</i>						
1028	..	1	Greenland.	.....	University Museum, Copenhagen.	Alcoholic.
1021	..	3	Grand Manan Island.	.....	Wm. Stimpson.	"

Ophiacantha setosa MÜLL. & TROSCH.

Asterias setosa RETZIUS. Dissertatio, p. 30.

Ophiura rosularia GRUBE (non Lamk.). Actin. Echin. u. Wür., p. 20.

Ophiacantha setosa MÜLL. & TROSCH. Syst. Asteriden, p. 106.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
422	Oran, Algeria.	.....	Jardin des Plantes.	Alcoholic.

OPHIOPHOLIS MÜLL. & TROSCH.

TYPE OF THE GENUS, *O. bellis*.

Disk more or less covered with grains, or little spines. Teeth. No tooth-papillæ. Mouth-papillæ on the sides of the mouth-frames. Arm-spines short, flat, stout, arranged along the sides of the side arm-plates. Upper arm-plates surrounded by a rim of supplementary pieces. The lower spine of the outer arm-joints bearing hooks. General structure rather coarse and stout. Two genital slits beginning outside the mouth-shields.

SPECIES HEREIN DESCRIBED.

Primary plates naked in brachial and interbrachial spaces,	<i>O. bellis</i> .
Primary plates naked in brachial spaces only,	<i>O. Kennerlyi</i> .
No naked primary plates,	<i>O. Caryi</i> .

Ophiopholis bellis LYMAN. (Plate I. Fig. 4-6.)

STELLA SCOLOPENDROIDES; *bellis scolopendrica* LINCK. De Stel. Mar., p. 52, Pl. XL. fig. 71. 1733.
Asterias aculeata O. F. MÜLL. Zool. Dan., p. 29, Pl. XCIX. 1789.
Ophiura bellis JOHNS. Mag. Nat. Hist., p. 595. 1835.
Ophiocoma bellis FORBES. British Starfishes, p. 53.
Ophiopis scolopendrica MÜLL. & TROSCH. Syst. Asteriden, p. 66.
Ophiopholis aculeata LÜTKEN. Addit. ad Hist. Oph., p. 60.

Special Marks.—In alcohol, the prevailing tint is brownish-red. Primary plates in the brachial and interbrachial spaces. Disk grains of adult specimens elongated, like short spines.

Description of a Specimen.—Diameter of disk, 20.5^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 7^{mm}; width of arm without spines, 3^{mm}; length of arm, 142^{mm}; distance from outer side of mouth-shield to inner points of teeth, to that between outer corners of mouth-slits, 3.1:3.6. Mouth-papillæ thin, flat, scale-like, squarish, with rounded corners; six to each angle of the mouth. Teeth twelve, squarish, short, middle of the cutting edge thickened; upper ones growing narrower; two or three lowest ones often split in two. Mouth-shields nearly oval, with a slight point within; length to breadth, 1.5:2. Side mouth-shields stout, closely soldered with surrounding parts, meeting within. Under arm-plates somewhat irregular, broader than long, a little separated; inner side

nearly straight, and a little shorter than the outer; outer side nearly straight; outer corners strongly rounded; length to breadth (twelfth plate), 1.2:1.7; the first six plates are proportionately longer, and much more rounded, than those beyond; their outer side often has a slightly re-entering curve; at the tip of the arm the plates are longer than broad, with the outer and lateral sides quite straight, and an angle at the inner end. Side arm-plates encroaching a little below, between under arm-plates; cleanly separated from each other by naked skin. Upper arm-plates nearly oval, stout, sometimes broken in two; length to breadth (third plate), 1.2:1.9. Supplementary pieces ten or twelve, very closely wedged together, and variously distorted, often broken in two; those on the sides sometimes encroaching between the rows of arm-spines. Near the end of the arm, upper arm-plates nearly round; supplementary pieces bead-like, not crowded. Disk closely beset, above and below, with short, flattened spines, except on the primary plates, and a small space outside the mouth-shields; these spines vary in length, being short and granular towards the middle of the disk and at the bases of the arms, but longer and more closely set in the interbrachial spaces below; their greatest length is about .7^{mm}; primary plates rounded, the middle ones smallest; some of those in the interbrachial spaces often overgrown by spines; the largest ones having a diameter of 1.7^{mm}. Radial shields having the form and appearance of primary plates. Arm-spines six, stout, flattened, cut square off at the end; four upper ones nearly equal, very broad, flat, and square; two lower ones smaller and more conical; lengths to that of lower arm-plate (ninth joint), 1.5, 1.5, 1.5, 1.3, 1.3, 1.1:1.2; towards the end of the arm, spines rounded and conical, usually five; lowest spine on tip joints armed with hooks. Tentacle-scale nearly round, stout, flat; length to that of under arm-plate, .6:1.2; towards the end of the arm the tentacle-scales are much longer than broad, and are nearly as long as the under arm-plates. Color, in alcohol: above, dull brownish-red (lake and burnt-umber) somewhat variegated; below, interbrachial spaces same as upper surface, but much paler; the rest yellowish.

Variations.—Even in alcohol the coloration is seen to be quite changeable; sometimes the upper surface is uniform dull brownish-red, of different shades in different specimens; or the disk may be nearly white, with reddish arms; or both arms and disk may be mottled reddish and yellowish. Professor Agassiz's colored drawings show that of the living animals scarcely two are alike. The principal patterns are: disk and arms brownish orange, more or less variegated; disk dark green, with a light-green central star, light-green banded arms, and white radial shields; disk and arms indigo blue, variegated with greenish and reddish; disk with a light centre and dark margin, and light-

green arms, banded with lake-red; &c. The very young animals cling to the arms of their parents, sometimes one on top of the other. A young one, with a disk of 1.7^{mm}, had arms 4.4^{mm} in length; the disk had only a few scattered, small, trifid spines round the margin; in the centre was a rosette of primary plates, which still preserved their form; these were surrounded by twenty-five more plates, viz., a primary plate and two radial shields in each brachial space, and two primary plates in each interbrachial; all the plates were very thin, and composed of a network of fine spiculæ; the upper arm-plates were longer than broad, broadest in front, and rounded throughout; in place of supplementary pieces there were two or three little thorny grains; below, the lower arm-plates were longer than broad, with outer and lateral sides nearly straight, and at the inner end an angle; the mouth-shields and side mouth-shields were much as in the adult; the teeth very few in number; the arm-spines four, very thorny, the lowest one on the outer joints armed with hooks. As the animal grows old, the primary plates become more numerous and more widely separated; the spines of the disk grow smooth and granular, and increase in numbers; then they elongate, and finally become so developed as to obliterate some of the primary plates; the arm-spines, from being slender and conical, become stout and flattened, and the teeth increase greatly in number. Dr. Lütken gives the following table, to show the relative increase of parts.

Diam. of Disk.	Length of Arm.	No. of Joints.	Joints with Hooks.	Joints without Circle of Grains.
2 ^{mm} .	6 ^{mm} .	20	15	12
3		40	27	
4		45-50	33	20
6	33	63		
10	60	86		
14	72	105	40-50	18

According to this, both the disk and the arms continue to grow, but the latter the faster. During the growth of the arms new joints are formed, and this increase of joints seems greatest in the very young animal. The new joints appear at the tip of the arm, and not at the base, next the mouth. In moderate sized specimens the arms are usually not more than four or five times longer than the diameter of the disk.

O. bellis is distinguished from *O. Caryi* and *O. Kennerlyi* by greater size and different number of naked primary plates. On the Grand Manan it is abundant, at low-water-mark of the spring tides, among sea-weed (A. E. Verrill). In Boston Harbor the young are often found on bits of floating sea-weed (Dr. Wheatland). On the Scandinavian coasts it has been dredged in from three to sixty fathoms (Hollbüll,

&c.). If the "*Ophiocoma*" taken by Dr. Wallich,* on a sounding line, at the astounding depth of 1,250 fathoms, is this species, it has the most extraordinary bathymetrical range.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
165	..	12+	Grand Manan Island.	Aug. 21, '57.	J. E. Mills.	Alcoholic.
166	..	12+	Grand Manan Island.	Oct. 2, 1857.	J. E. Mills.	"
167	..	12+	Grand Manan Island.	Aug. 10, Sep. 29, 30, Oct. 3, '57.	J. E. Mills.	"
168	..	5	Grand Manan Island.	Sep. 22, '57.	J. E. Mills.	"
169	..	4	Eastport, Me.	.....	Wm. Stimpson.	"
170	..	3	.....	.....	Prof. Sars, 1852.	"
171	..	2	Bergen.	.....	Prof. Sars, 1852.	"
172	..	6	Greenland.	.....	Prof. Sars, 1852.	"
173	..	10	Phillips Beach, Mass.	Feb. 14, '48.	Prof. Agassiz.	"
174	..	4	Nahant? Mass.	.....	Prof. Agassiz.	"
175	..	9	Massachusetts?	.....	Prof. Agassiz.	"
176	..	12+	Nahant, Mass.	.....	Prof. Agassiz.	"
177	34 ^a	3	Norway.	.....	University Museum, Copenhagen.	"
178	34 ^b	3	Greenland.	.....	University Museum, Copenhagen.	"
179	34 ^c	1	Iceland.	.....	University Museum, Copenhagen.	"
180	34 ^d	8	Kattegat and Oresund.	.....	University Museum, Copenhagen.	"
181	34 ^e & f	10	Greenland.	.....	University Museum, Copenhagen.	"
182	..	12+	Boston Bay.	.....	Prof. Agassiz.	"
183	..	12+	Grand Manan Island.	Oct. 5, 1857.	J. E. Mills.	"
184	..	12+	Eastport, Me.	.....	J. E. Mills.	"
185	..	1	Fayal?	.....	Mr. Higginson.	"
186	..	12	Eastport, Me.	July 1, 1851.	.....	"
187	..	12	Trenton, Me.	July, 1860.	Messrs. Verrill and Shaler.	"
188	..	12+	Grand Manan Island.	1859, Sum'er.	A. E. Verrill.	"
189	..	1	Marked "Florida," but unquestionably wrong.	.....	.....	"
190	..	5	Massachusetts.	.....	Prof. Agassiz.	Dried.
191	..	12	.....	.....	.....	"
192	..	2	Nahant.	.....	Prof. Agassiz.	"
193	..	12+	Labrador.	.....	Dr. Horatio Storer.	"
194	..	1	Massachusetts Bay.	.....	.....	"
343	..	6	Straits of Bellisle.	.....	A. S. Packard, Jr.	Alcoholic.
425	Newfoundland.	.....	Jardin des Plantes.	"
373	Nahant, Mass.	.....	Alex. Agassiz.	"
374	Portland, Me.	.....	.....	"
375	Eastport, Me.	.....	.....	"
376	Grand Manan Island.	.....	.....	"
<i>Smithsonian Institution.</i>						
1027	..	1	Greenland.	.....	University Museum, Copenhagen.	Alcoholic.
1064	..	12+	Massachusetts.	.....	Wm. Stimpson.	"

* G. C. Wallich, M. D., on Animal Life at Vast Depths, p. 22. 1860.

Ophiopholis Kennerlyi LYMAN.

Ophiopholis Kennerlyi LYMAN. Proceed. Boston Soc. Nat. Hist., VII. p. 200.

Special Marks. — No naked plates in the interbrachial spaces of the disk, above.

Description of a Specimen. — Diameter of disk, 8^{mm}; outer edge of mouth-shield to outer corner of opposite mouth-slit, 3.4^{mm}; width of arm without spines, 2^{mm}; length of arm, 35.3^{mm}. Mouth-papillæ thin, flat, square, with corners rounded; three on each side. Teeth short, broad, square, stout. Mouth-shields very closely soldered with side mouth-shields, rather small, nearly oval; length to breadth, .7 : 1. Under arm-plates nearly square, corners a little rounded, and outer side bounded by a slightly re-entering curve; length to breadth, 1 : 1. Side arm-plates small, and little prominent. Upper arm-plates irregular oval, sometimes broken in two, more or less encroached on by supplementary pieces, which bound their outer and lateral sides; length to breadth, near base of arm, .8 : 1.5. The supplementary pieces form a close line; they are thick and angular, vary somewhat in size, and, near base of arm, from seven to ten in number; farther out, fewer; and near the tip none at all. Disk, above, closely and evenly covered with round grains, among which appear a few small, round primary plates; one in centre, and one or two in each brachial space; none at all in the interbrachial spaces; diameter of central plate, .7^{mm}. Disk, below, closely set with short, stout, smooth spines, about .3^{mm} long. Arm-spines very stout, short, thick, rounded; the longest about length of arm-joints; lowest one much the shortest, blunt, conical; second spine same shape, but longer; third and fourth longest, broad, thick, and blunt; fifth same shape, but shorter; usually five spines; sometimes, close to disk, six; near tip of arm, the lower spine has the form of a double hook. Color, in alcohol: purplish pink, with obscure bands of a darker shade on arms; an obscure line of whitish running lengthwise of the arms; in the position of each radial shield, an irregular patch of white; below, interbrachial spaces mottled reddish and white; mouth-apparatus whitish; lower arm-plates whitish, edged with pink; other parts same as upper surface, but lighter.

Variations. — A specimen of about the same size as the preceding, had usually three, instead of two, primary plates in each brachial space on the upper surface of the disk; also, a distinct line of white, running quite round the disk, near its edge. A young one, with a disk 3^{mm} in diameter, had arms 12.5^{mm} in length; the arm-spines were more slender,

and were thorny, as were also the spines and grains of the disk ; in the centre of the disk a patch of white, and another at the base of each arm.

This species is interesting, as being the second of a genus which before had but one member. It is distinguished from *O. bellis* by the close and regular granulation of the disk, without spines above, and by having no primary plates in the interbrachial spaces. It seems, also, to be a much smaller species.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
197	..	1	Mendocino, Cal.	.....	Alex. Agassiz.	Alcoholic.
198	1062	1	Puget Sound.	.....	Dr. Kennerly.	"
<i>Smithsonian Institution.</i>						
1062	..	3	Puget Sound.	.....	Dr. Kennerly.	Alcoholic.

Ophiopholis Caryi LYMAN.

Ophiopholis Caryi LYMAN. Proceed. Boston Soc. Nat. Hist., VII. p. 261. 1860.

Special Marks.—Small species ; disk about 8^{mm} in diameter, and closely covered with fine grains, without naked plates.

Description of a Specimen.—Diameter of disk, 8^{mm} ; from outer side of mouth-shield to outer corner of opposite mouth-slit, 3.3^{mm} ; width of arm without spines, 1.5^{mm} ; length of arm, 26.5^{mm} ; distance from outer side of mouth-shield to inner points of teeth, to that between outer corners of mouth-slits, 1.5 : 1.5. Mouth-papillæ flat, rounded, scale-like, three or four on each side. Teeth about eleven, broad, short, stout, flat, square ; uppermost and lowest ones narrower than those in middle ; uppermost one longest, with a rounded cutting edge ; lowest one often split in two. Mouth-shields irregular, small, usually rounded rhomboidal ; length to breadth, .6 : .8. Side mouth-shields nearly meeting within, large and curved, closely soldered with surrounding parts. Under arm-plates a little separated, squarish, with curved lateral sides ; outer side slightly re-enteringly curved ; inner side rather shorter than the outer, and made up of three short lines, making an angle with each other ; length to breadth (eighth plate),

.7 : .6. Upper arm-plates irregular oval, with outer side most curved ; length to breadth (third plate), .6 : 1. Supplementary pieces irregular, but usually oblong and angular, the largest ones near lateral corners of each plate ; near base of arm, eight or nine to each plate ; near the end of the arm there are still eight or nine supplementary pieces, but the upper arm-plates are nearly round. Disk, above, closely and perfectly covered with small rounded grains ; about 100 to a square *mm.* ; below, interbrachial spaces thickly beset with very short, stout, sharp spines, about .1^{mm.} long. Arm-spines five, sometimes six ; short, stout, blunt, more or less flattened ; three upper ones largest ; second spine stoutest and broadest of all ; two lowest smaller and more conical ; lengths to that of under arm-plate (eighth joint), .5, .5, .5, .4, .3 : .7 ; near tip of arm, spines more rounded and tapering. Tentacle-scale one, thin, flat, narrowest at the base, cut off square at the end, about as long as lowest arm-spine. Color, in alcohol : above, nearly uniform lake-pink, a little deeper near edges of disk ; along arms a faint, broken line of lighter ; below, interbrachial spaces, near edge of disk, same as upper surface, but fading to nearly white towards the mouth ; under arm-plates and mouth-parts white, the former edged with reddish along their lateral sides ; side arm-plates and arm-spines same as upper surface, but lighter.

Variations. — A young one, with a disk of 2.7^{mm.}, had arms 7.6^{mm.} in length ; the color was mottled pink and white ; the disk was pretty closely covered with grains, or very short spines, each bearing a crown of three little thorns ; the arm-spines were rounded and conical, but not at all flattened. Another specimen had a disk of only 2.2^{mm.}, and arms of 8.1^{mm.} ; this had all the supplementary pieces of the upper arm-plates covered with minute thorns. The smallest specimen had a disk of 1.9^{mm.}, and arms of 5.4^{mm.} ; the disk granulation, arm-spines, mouth-papillæ, and supplementary pieces of the arm-plates, were all thorny ; arm-spines five ; mouth-papillæ two ; lower arm-plates longer than broad, narrowest within, with a re-entering curve on the outer side, and a notch on the inner ; upper arm-plates longer than broad, rounded.

This small species is distinguished from *O. Kennerlyi* and *O. bellis* by having the disk entirely covered with fine grains, without naked plates.

It is not impossible that this may be but a variety of *O. Kennerlyi* ; but as I have seen the *young* of both, with the distinctive specific marks, I prefer to keep the names as they now stand.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
195	..	12+	Mendocino, Cal.	.....	Alex. Agassiz.	Alcoholic.
196	..	4	San Francisco, Cal.	.....	T. G. Cary.	"

OPHIOSTIGMA LÜTKEN.

TYPE OF THE GENUS, *O. isacanthum* Lyman.

Disk granulated. Teeth. No tooth-papillæ. Basal mouth-papillæ very long, stout, and broad; the others small and few, arranged so as to cover the end as well as the sides of the angle of the mouth. Arm-spines three, short, smooth, arranged along the sides of the side arm-plates. Side mouth-shields large; nearly, or quite, touching, so as to form a ring round the mouth. Mouth-apparatus, as a whole, forming a distinct, raised pentagon. Two genital slits, beginning outside the mouth-shields.

Ophiostigma isacanthum LYMAN. (Figs. 8, 9.)

Ophiura isacantha SAY. Journ. Phil. Acad., V. p. 150. 1825.

Ophiostigma moniliforme LÜTKEN. Addit. ad Hist. Oph., p. 132.

Special Marks. — Upper arm-plates cleanly arched without; lower arm-plates bounded within by an inner side and two inner laterals.

Description of a Specimen. — Diameter of disk, 5^{mm.}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 2.1^{mm.}; width of arm without spines, .8^{mm.}; length of arm, 23.5^{mm.}; distance from outer edge of mouth-shield to inner points of teeth, to that between outer corners of mouth-slits, 1 : 1.2. Mouth-papillæ, four to six. Teeth four, stout, short, squarish, with the cutting edge a little re-enteringly curved. Mouth-shields broad heart-shaped, with a sharp peak within,

outer side curved, and inner sides re-enteringly curved; length to breadth, .5 : .7. Side mouth-shields wider without than within, touching

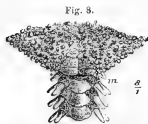


Fig. 8.
Ophiostigma isacanthum. (Upper side.)
m, radial scale.

each other within for their whole breadth. Under arm-plates squarish, broader than long; bounded without and on the two lateral sides by nearly straight lines; within by an inner side and two inner laterals; length to breadth

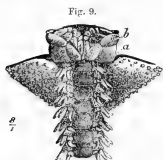


Fig. 9.
Ophiostigma isacanthum. (Lower side.)
a, mouth-shield; *b*, side mouth-shield.

(ninth plate), .3 : .5; first under arm-plate diamond-shaped, and very small. Side arm-plates encroaching between the upper and under plates, but more between the former. Upper arm-plates oval diamond-shaped, cleanly curved without, somewhat pointed at the lateral corners, and with a rounded angle within; length to breadth (fifth plate), .3 : .7. Spines of disk very short and blunt, like elongated grains; standing, not close, but evenly. The outer ends of the radial shields are indicated by slight swellings. Arm-spines short, blunt, little tapering, evenly rounded, of nearly equal lengths; upper one a trifle the stoutest; length to that of under arm-plate, .4 : .3. Tentacle-scales two, rather stout, longer than broad, inside one larger. Color, when dry, white.

Variations. — Dr. Lütken mentions a six-armed specimen. He speaks of the color as commonly variegated brown, and mentions one black individual. Say, on the contrary, described his specimen as white, with green bands on the arms. An alcoholic specimen in the Cambridge Museum is light brown. The arms seem commonly to be from four to six times as long as the diameter of the disk.

This rare species is said to be distinguished from *O. tenue* by the form of the under arm-plates. It has been taken at St. Thomas, in four fathoms of water (A. H. Riise); at St. John (Professor Prosch); and in Florida (Professor Agassiz).

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
252	..	1	Florida.	.....	Prof. Agassiz.	Alcoholic.
253	..	1	Cape Florida.	.....	G. Wurdeman.	"
254	..	1	Florida.	.....	Prof. Agassiz.	Dried.

OPHIACTIS LÜTKEN.

TYPE OF THE GENUS, *O. Krebsii*.

Disk circular, robust, closely covered with radial shields and overlapping scales, the latter bearing a greater or less number of small spines. Teeth. No tooth-papillæ. A few (usually two or four) small, delicate mouth-papillæ to each angle of the mouth, situated near the outer corner of the mouth-slit. Arm-spines arranged along the sides of the side arm-plates. Two genital slits beginning outside the mouth-shields.

GROUPING OF SPECIES HEREIN DESCRIBED.

Five arms in the adult,	Two mouth-papillæ,	Radial shields separated and very small; side mouth-shields broad, and making a continuous ring round the mouth,	} <i>O. simplex</i> .
		Mouth-shields much broader than long; arm-spines smooth, tapering, differing much in length,	
Six arms in the adult,	Four mouth-papillæ,	Arm-spines very short, blunt, rough; nearly equal,	} <i>O. Mülleri</i> .
		A slight lobe on the outer side of the upper arm-plate,	
			} <i>O. Krebsii</i> .
			} <i>O. virescens</i> .
			} <i>O. sexradia</i> .

Ophiactis simplex LÜTKEN.

Ophiopsis simplex LE CONTE. Proceed. Phil. Acad., V. p. 318. Nov., 1851.

Ophiactis (Ophiopsis) simplex LÜTKEN. Addit. ad Hist. Oph., p. 130.

Ophiactis Örstedii? LÜTKEN. Addit. ad Hist. Oph., p. 129.

Ophiactis arenosa? LÜTKEN. Addit. ad Hist. Oph., p. 129.

Special Marks. — Radial shields widely separated, and comparatively small; spines very numerous in the lower interbrachial spaces; disk-scales inclining to a circular form, rather regular.

Description of a Specimen. — Diameter of disk, 4^{mm}.; from outer side of mouth-shield to outer corner of opposite mouth-slit, 1.7^{mm}.; width of arm without spines, 1.1^{mm}.; length of arm about 28^{mm}.; distance from

outer side of mouth-shield to inner points of teeth, to that between outer corners of mouth-slits, 1 : .9. Mouth-papillæ, two to each angle of mouth, situated near outer end of mouth-slit, about as broad as long, thin, angular. Cutting edge of teeth re-enteringly curved. Mouth-shields broader than long, nearly oval, with a slight peak within; length to breadth, .4 : .5; madreporic shield much larger. Side mouth-shields very large, about as broad as the length of the mouth-shields, re-enteringly curved at the outer corners of the mouth-slits; meeting fully within, and also touching their neighbors without, so as to cover the first under arm-plate. Under arm-plates even, a little overlapping, about as broad as long, rather thick; outer side cleanly curved, laterals short and nearly straight; within there are an inner side and two inner laterals, which are short and nearly equal, and are often more or less combined in a broken curve; length to breadth (tenth plate), .5 : .4. Side arm-plates small, making a narrow, prominent ridge for the arm-spines. Upper arm-plates regular, a little overlapping, much broader than long; bounded without and within by straight lines, and on the sides by curves; a little narrower within than without; first two or three plates much shorter than those beyond; length to breadth (seventh plate), .5 : 1. Disk-scales pretty regular and rounded, and rather thick; in the centre a conspicuous primary plate, with an indistinct rosette about it; in each interbrachial space a radiating, connected row of rounded primary plates, between which and the radial shields there are two or three pretty regular rows of smaller scales, about 16 to a square *mm*. Radial shields small, pointed within, widely separated by a wedge of different sized scales; length to breadth, .8 : .4. Along edge of disk, and on interbrachial spaces below, numerous short spines, of which there are also a few scattered about the back of the disk. Arm-spines five, only moderately stout; round, tapering, blunt, slightly rough; three middle ones longest, lowest one shortest; lengths to that of under arm-plate (sixth joint), .3, .4, .4, .4, .2 : .4. Tentacle-scale much longer than broad, nearly oval, more than half as long as the under arm-plate. Color, dry: above, and interbrachial spaces below, very dark olive-green; rest of lower surface yellowish.

Variations. — Of fourteen specimens that I have examined, the two largest had only five arms; the rest, which were much smaller, had six; except one small specimen, which had but four. A young one had the following characters: diameter of disk, 1.2^{mm}; length of arm, 4.2^{mm}. Upper arm-plates, most of them, separated by side arm-plates, heart-shaped, somewhat swollen; disk covered with large, rounded, swollen scales, of which the eight middle ones form a rosette; radial shields not conspicuous, and smaller than most of the disk-scales; a very few minute spines on the disk; arm-spines four, more slender than in the

adult; under arm-plates pentagonal, with an angle inward; longer than broad, nearly separated by side arm-plates; two full arm-joints admitted into the disk. The proportions of the disk to the arms may be as follows: 1.2:4.2, 1.6:6, 2.5:15, 4:28. The color of the young, when dry, is tawny brown, the arms being barred with greenish brown; as they grow larger, the tendency of tint is more towards greenish. Dr. LeConte says the color of the living animal is "pale beneath, above blackish brown; arms marked with a few paler bands." He adds, that "the scales are *all* finely granulated" (spinous), so that, in the dried specimens, these spines have probably for the most part been rubbed off.

It is probable that the adult of this species has always five arms, while the young have six. It is easily distinguished by its small radial shields, which, together with the form of its arm-spines and upper arm-plates, place it nearer to *Amphiura* than are the other species of *Ophiactis*. I feel pretty sure that *O. Örstedii*, of which Dr. Lütken got one specimen, through Dr. Örsted, from Puntarenas, is the same as this species. The only noteworthy difference is in the shortness of the arms, which were apparently broken in the above-mentioned specimen, and could not therefore be accurately measured. It is also possible that *O. arenosa* Ltk. will fall among the synonymes of *O. simplex*. But these questions must be answered by future observers.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
225	1198	1	Panama.	.....	Dr. J. LeConte.	Dried.
<i>Smithsonian Institution.</i>						
1198	..	12+	Panama.	.....	Dr. J. LeConte.	Dried.
? 1186	..	2	West Coast Nicaragua.	.....	Capt. Dow.	"

Ophiactis Kröyeri LÜTKEN.*Ophiactis Kröyeri* LÜTKEN. Vidensk. Meddelelser. Jan., 1856.*Ophiactis Kröyeri* LÜTKEN. Addit. ad Hist. Oph., p. 130.

Special Marks. — Mouth-shields much broader than long, with a peak within and a small tail without. Six (or five) arm-spines, all smooth; fourth (or third) from the top much the longest.

Description of a Specimen. — Diameter of disk, 5^{mm}.; from outer side of mouth-shields to outer corner of opposite mouth-slit, 2.5^{mm}.; width of arm without spines, 1.5^{mm}.; length of arm about 25^{mm}.; distance from outer side of mouth-shields to inner points of teeth, to that between outer corners of mouth-slits, .9 : 1.4. Mouth-papillæ, two to each angle of jaw, thin, wider than long, with a bevelled, cutting edge. Teeth nine, short, thick, stout, and crowded; third and fourth from below broadest; uppermost one smallest and narrowest. Mouth-shields much broader than long, with a little tail or peak without, and a rounded peak within; lateral corners rounded; length to breadth, .5 : .9. Side mouth-shields small, narrow, irregularly triangular, not meeting within; they are unusually variable in size and shape. Under arm-plates without sharp angles, broader than long, outer side and corners curved, lateral sides nearly straight, inner side strongly curved, forming sometimes a rounded angle; first plate short and very small, often separated from second plate by side mouth-shields; next three or four plates smaller than those immediately beyond; length to breadth (eighth plate), .6 : 1. Side arm-plates projecting strongly, encroaching a little below. Upper arm-plates a good deal broader than long, squarish; outer and lateral sides nearly straight, inner side slightly curved; corners a little rounded; length to breadth (twelfth plate), .6 : 1; the first two or three plates are smaller and oval. Disk-scales much crowded, varying somewhat in length, but of nearly the same size; about 12 to a square mm.; in the middle is a single primary plate, and there is a connected, radiating row, of three or four plates, in each interbrachial space; along margin of disk, a good number of small, stout, conical spines, about .3^{mm}. long; there are a few others scattered on upper surface of disk, and some on the interbrachial spaces below. Radial shields swollen, long triangular, with their points inward; where they are joined, without, there is a slight lobe; for the rest of their length they are separated by a stout wedge of one, two, or three scales; length to breadth, 1.5 : .8. Arm-spines, near base of arm, six, very smooth, rounded, hardly tapering, blunt and rounded at the point; uppermost and lowest spines shortest, fourth from the top the longest, others inter-

mediate in length; lengths to that of under arm-plate (ninth joint), .5, .8, .9, 1.4, .8, .6 : .6; near tip of arm, only four spines, which are nearly equal. Tentacle-scale stout, nearly round, rather large; length to that of under arm-plate, .3 : .6. Color, in alcohol: light gray.

O. Kröyeri is easily distinguished by the shape of its upper and under arm-plates, and by its six smooth spines, of which the fourth is much the longest.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
436	Callao.	.....	Jardin des Plantes.	Alcoholic.
<i>Smithsonian Institution.</i>						
1024	..	1	Callao.	.....	University Museum, Copenhagen.	Alcoholic.

Ophiactis Mülleri LÜTKEN.

Ophiactis Mülleri LÜTKEN. Additamenta ad Hist. Oph., p. 127.

Special Marks. — One mouth-papilla, usually six arms; upper arm-plates regular oval; near the edge of the disk a few spines.

Description of a Specimen. — Diameter of disk, 3.3^{mm.}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 1.5^{mm.}; width of arm without spines, .8^{mm.}; length of arm, 17^{mm.}; distance from outer side of mouth-shield to inner points of teeth, to that between outer corners of mouth-slits, .7 : .6. Mouth-papillæ, one on each side, placed near outer corner of mouth-slit; thin, flat, rounded. Teeth four, longer than broad, crowded; cutting edge wavy; lowest tooth smallest; between it and the lower end of the jaw there is a vacant space, without any teeth or papillæ. Mouth-shields a little variable, usually broad diamond-shape, with angles more or less rounded; length to breadth, .3 : .3. Side mouth-shields more than half as large as mouth-shields, stout, rather broad; not meeting within, but sometimes touching their next neighbors at the outer end of mouth-slit. Under arm-plates, near base of arm, short, rounded, heart-shape, with a more or less distinct angle inward; farther out on the arm they become more angular, and are bounded within by a distinct angle, without by an outer side and two

short outer laterals, and on the sides by straight laterals, all the corners being somewhat rounded; length to breadth (eighth plate), 4:4. Side arm-plates stout, regular, encroaching a little below. Upper arm-plates cleanly and regularly oval, stout, but not swollen, slightly overlapping; length to breadth (third plate), 4:7. Disk-scales, near the margin, about 50 to a square *mm.*; considerably smaller below, but larger near the centre, above; a very uneven rosette of primary plates in the middle of the disk, and usually one elongated plate in each brachial and interbrachial space; near edge of disk, a few very short spines. Radial shields either touching for their whole length, except their inner points, or else more or less separated by one or two very narrow scales; length to breadth, .9:4. Arm-spines four, second one from the top much the stoutest and roughest, lowest one smallest, the other two intermediate in size; all are nearly cylindrical, and somewhat tapering; lengths to that of under arm-plate (eighth joint), .3, .4, .3, .2:4. Tentacle-scale one, very similar in shape and size to the mouth-papillæ. Color, in alcohol: upper surface and interbrachial spaces below variegated with sap-green, dull cobalt blue and white, the principal tint being green; remainder of under surface nearly white. The color is about the same in the living animal.

Variations. — The above-described specimen had only five arms, but, as a rule, the number is six, and of these two or three are almost always smaller than the rest. The arms vary much in number; occasionally a specimen may be seen with only *one*. A young one had five arms about 3.5^{mm.} long, the diameter of the disk being 1.2^{mm.}; lower arm-plates long pentagonal, with an angle inward; upper arm-plates broad heart-shape, with a curved outer side, and straight inner laterals; they had a peak within, and were completely separated by the encroachment of the side arm-plates; upper side of disk without any spines, and covered by the radial shields, and a few large, irregular scales, some of which formed a sort of rosette in the centre. It is said that there are sometimes five arm-spines, but I have never seen more than four; and many of the basal joints have but three.

O. Mülleri may be recognized by its single mouth-papilla, oval upper arm-plates, and six arms.

It has been found abundantly at St. Thomas (A. H. Riise). At Cape Florida I found great numbers, living in colonies, at low-water-mark. The little animals were clinging to a kind of spreading, greenish sponge, which grows like a thick net-work, and often attains a thickness of a foot, and a diameter of four or five feet.

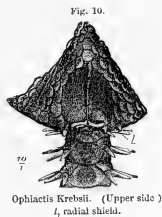
LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
215	..	12+	Cape Florida.	Feb. 1856.	T. Lyman.	Alcoholic.
216	..	4	St. Thomas, W. I.	.....	A. H. Rüse.	"
217	..	2	Florida.	.....	G. Wurdeman.	"
218	60	6	West Indies.	.....	University Museum, Copenhagen.	"
<i>Smithsonian Institution.</i>						
1015	..	1	West Indies.	.....	University Museum, Copenhagen.	Alcoholic.
1157	..	5	St. Thomas, W. I.	.....	A. H. Rüse.	"
1083	..	3	St. Thomas, W. I.	.....	A. H. Rüse.	Dried.
1110	..	5	St. Thomas, W. I.	.....	A. H. Rüse.	"

Ophiactis Krebsii LÜTKEN. (Figs. 10, 11.)*Ophiactis Krebsii* LÜTKEN. Addit. ad Hist. Oph., p. 126.

Special Marks. — Commonly six arms and five arm-spines. A very slight lobe on the outer side of the upper arm-plates. Four mouth-papillæ to each angle of the mouth.

Description of a Specimen. — Diameter of disk, 3.3^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 1.6^{mm}; width of arm without spines, .9^{mm}; length of arm, 19^{mm}; distance from outer side of mouth-shield to inner points of teeth, to that between outer corners of mouth-slits, .8 : .8. Mouth-papillæ, four to each angle of the mouth, flat, thin, rounded, longer than broad. Teeth six, uppermost one tapering and a little the longest; the rest flat, squarish, longer than broad, with a cutting edge thickened at its middle point. Mouth-shields much rounded diamond-shape, with a little tail on the outer side; length to breadth, 4 : 3. Side mouth-shields stout, barely meeting within. Under arm-plates about as long as broad, octagonal, the inner lateral sides being longest; length to breadth (tenth plate), 4 : 4. Side arm-plates encroaching a little below, projecting laterally a good deal. Upper arm-plates oval, thick, slightly swollen, with a very small lobe on the outer



Ophiactis Krebsii. (Upper side)
L, radial shield.

side; this lobe is not so distinct on the basal plates as on those a little farther out on the arm; length to breadth (eighth plate), 4:7. Scales of disk all pretty small and thin, very irregular; no rosette of primary plates in the middle, but sometimes a single primary plate may be distinguished in the interbrachial spaces; scales

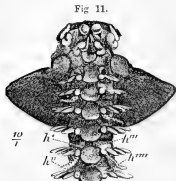


Fig. 11.
Ophiactis Krebsii. (Lower side)
h' h'', inner lateral sides of under arm-plates; *h'*, outer side; *h'''*, lateral side.

near the margin, about 60 to a square *mm.*; scales of interbrachial spaces, below, very fine. Radial shields regular, elongated, pear-seed shape, partially separated by one or two narrow scales; length to breadth, 1:4. There are a few scattered, short spines along the disk margin, and also towards the centre. Arm-spines five, near the disk six; rounded, somewhat tapering; second one from the top largest; first and third of about the same size; the rest growing smaller to the lowest one; lengths of second and sixth spines to that of under arm-plate (fifth joint), 4:2:6. Tentacle-scale one, similar to the mouth-papillæ. Color, in alcohol: variegated bright sap-green and whitish; radial shields green, tipped with white; arms banded green and white.

Variations. — Not so many individuals have only two or three arms as in *O. Mülleri*; the usual number is six. A young one had the following characters: diameter of disk, 1.5^{mm.}; length of arms, 6^{mm.}; upper arm-plates triangular, with a more or less sharp angle, turned inward, not separated by side arm-plates; under arm-plates longer than broad, with an angle within, lateral and outer sides nearly straight, corners rounded; otherwise it resembles the adult, even to the number of the arm-spines. A large specimen had a disk of 4.2^{mm.}, and arms of 20^{mm.}. The disk is said to grow as large as 7^{mm.}. The side mouth-shields commonly meet within.

This species is common at St. Thomas (A. H. Rüse, Mr. Krebs) and at Santa Cruz (Mr. Örsted); I have found it at Cape Florida; Rev. J. E. Mills, at Key West; and Professor Agassiz has dredged it as far north as Charleston, S. C., outside the bar of the harbor. It lives on corals and sponges, and has been found from low-water-mark to three fathoms. It may be distinguished from its six-armed neighbor, *O. Mülleri*, by having four mouth-papillæ instead of two, and having a slight lobe on the outer edge of the upper arm-plate; and from *O. virescens*, to which it stands very near, by regularly tapering arms and somewhat narrower upper arm-plates.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
219	..	6	St. Thomas, W. I.	.....	A. H. Riise.	Alcoholic.
220	..	1	Cape Florida.	Feb. 1856.	Theo. Lyman.	"
221	..	1	Key West, Fla.	Mh. 6, 1858.	J. E. Mills.	"
222	..	4	Charleston, S. C.	.....	Prof. Agassiz.	"
223	59	1	West Indies.	.....	University Museum, Copenhagen.	"
224	..	1	Bahamas.	.....	Dr. H. Bryant.	"
<i>Smithsonian Institution.</i>						
1020	..	1	West Indies.	.....	University Museum, Copenhagen.	Alcoholic.
1156	..	2	St. Thomas, W. I.	.....	A. H. Riise.	"
1109	..	3	St. Thomas, W. I.	.....	A. H. Riise.	"

Ophiactis virescens ÖRSTED & LUTKEN.

Ophiactis virescens LÜTKEN. Vidensk. Meddelelser. Jan., 1856.

Ophiactis virescens LÜTKEN. Addit. ad Hist. Oph., p. 128.

Special Marks.—In well-grown specimens, the arm is suddenly swollen near the disk. Arm-spines very thick; two uppermost usually largest. Upper arm-plates twice as broad as long, with a distinct lobe without.

Description of a Specimen.—Diameter of disk, 3.8^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 1.6^{mm}; width of arm without spines, 1.1^{mm}; length of arm, 15^{mm}; distance from outer side of mouth-shields to inner points of teeth, to that between outer corners of mouth-slits, .9 : .9. Mouth-papillæ, four to each angle of mouth; thin, flat, longer than broad. Teeth six, squarish, flat; lowest and uppermost one smallest; those below thicker than upper ones. Mouth-shields much rounded diamond-shape, with a point within, and often a little tail without; length to breadth, .4 : .3. Side mouth-shields very long and much bent; they meet within, and run side by side a little way, towards the teeth; their outer ends meet those of their neighbors, so as to cover the first under arm-plate. Under arm-plates about as long as broad, octagonal, the inner laterals being usually a little longer than the other sides; length to breadth (eighth plate), .5 : .4. Upper arm-plates oval, much broader than long, with a decided lobe on outer side; length to breadth (ninth plate), .5 : 1; first four or five plates not so broad as those immediately beyond, because the arm

is much narrower at its base than it is a little way out. Disk-scales less crowded and somewhat more regular than is common in the genus; there are about three parallel, radiating rows of rounded scales in the narrowest part of each interbrachial space; a few short spines are scattered here and there. Radial shields very straight along the side next their neighboring shield, but much curved along the side next the interbrachial space; length to breadth, 1.1 : .6; they are separated for nearly their whole length by a wedge of three long scales. Arm-spines near base of arm, five; two upper ones commonly thickest and largest; all of them very short, thick, rough, blunt, and a little tapering; lengths to that of under arm-plate, .5, .5, .4, .3, .2 : .5. Tentacle-scale flat, thin, broader than long, rounded at the end, resembling a mouth-papilla, but larger. Color, in alcohol: above, radial shields dark sap-green, tipped on their outer ends with lighter; rest of disk mottled with darker and lighter sap-green; arms banded and mottled with the same; below, mouth-parts and under arm-plates yellowish or greenish white.

Variations. — The color varies in intensity and somewhat in pattern. Sometimes the radial shields are not separated. A smaller one, with a disk of 2.7^{mm}, had arms about four times as long; the upper arm-plates were proportionately not so wide; the lower plates more rounded, and inclining to an angular heart-shape; the disk spines were pretty numerous, and longer than in larger specimens.

O. virescens is very like *O. Krebsii*, but differs in having the arm suddenly swelled, a little way from the disk, instead of regularly tapering; the arm-spines, also, are rather more rounded, thicker, and blunter, and the upper arm-plates proportionately a little wider, with a stronger outer lobe.

The first specimens were found at Realejo, in three fathoms of water, and at Puntarenas, by Dr. Ørsted; others have since been sent from Cape St. Lucas by Mr. Xantus.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
226	1166	1	Cape St. Lucas, Cal.	.....	J. Xantus.	Alcoholic.
<i>Smithsonian Institution.</i>						
1166	..	5	Cape St. Lucas, Cal.	.....	J. Xantus.	Alcoholic.

Ophiactis sexradia LÜTKEN.*Ophiolepis sexradia* GRUBE. Wiegmann's Archiv., p. 342. I. 1857.*Ophiactis sexradia* LÜTKEN. Addit. ad Hist. Oph., II. p. 126.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
227	..	12+	Sandwich Islands.	.....	A. Garrett.	Alcoholic.
403 sp.?	Zanzibar.	.....	.....	"

AMPHIURA FORBES.TYPE OF THE GENUS, *A. filiformis*.

Disk small and delicate, covered with naked, overlapping scales, and furnished with uncovered radial shields. Teeth. No tooth-papillæ. Six (rarely eight) mouth-papillæ to each angle of the mouth. Arms slender, even, more or less flattened. Arm-spines short and regular, arranged along the sides of the side arm-plates. Two genital slits to each interbranchial space.

GROUPING OF SPECIES HEREIN DESCRIBED.

Arms long and slim; middle arm-spine with a cross-piece at the end,	<i>A. filiformis</i> .
Arms very slim and of great length (often twenty-four times as long as diameter of disk), tapering only at their tips; outer mouth-papilla broadest; radial shields very long and narrow,	<i>A. gracillima</i> .
One mouth-papilla placed above the rest; radial shields long and narrow,	<i>A. Hollölli</i> .
Outer mouth-papilla broadest; under arm-plates pentagonal; arms of moderate length (about eight times the diameter of the disk),	<i>A. Chiajii</i> .
Outer mouth-papilla much the broadest; under arm-plates pentagonal; side mouth-shields large and meeting within,	<i>A. geminata</i> .
Under arm-plates broader within than without,	<i>A. squamata</i> .
Some of the disk-scales with toothed edges,	<i>A. tenera</i> .
Mouth-papillæ equal, separated; under arm-plates square; upper arm-plates large, overlapping, wider without than within, with rounded outer corners,	<i>A. pugetana</i> .
	<i>A. atra</i> .
	<i>A. urtica</i> .
	<i>A. occidentalis</i> .

Amphiura filiformis FORBES.*Asterias filiformis* O. F. MÜLLER. Zoöl. Dan. Prodr. 1776.*Ophiura filiformis* LAMK. Hist. Anim. sans Vertèb., II. p. 546. 1816.*Amphiura filiformis* FORBES. Linn. Trans., XIX. p. 151. 1843.*Ophiolepis filiformis* MÜLL. & TROSCU. Syst. Asteriden, p. 94. 1842.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
235	37	3	Oresund.	.....	University Museum, Copenhagen.	Alcoholic.

Amphiura gracillima LÜTKEN.*Ophiolepis gracillima* STIMPSON. Proceed. Boston Soc. Nat. Hist., IV. p. 224.*Amphiura* (*Ophiolepis*) *gracillima* LÜTKEN. Addit. ad Hist. Oph., p. 117.

Special Marks. — Arms slender, not tapering till near the tip, often twenty-four times as long as the diameter of the disk; mouth-shields angularly ovoid, long; side mouth-shields not meeting within.

Description of a Specimen. — Diameter of disk, 6^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 2^{mm}; width of arm without spines, .6^{mm}; length of arm about 140^{mm}; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 1.1 : 1. Mouth-papillæ, three on each side, outermost one much the largest, stout, longer within than without; innermost one running upwards to the teeth, stout, rounded, bead-like; middle one similar in size and shape. Teeth seven, longer than broad, stout, squarish, thickened at the middle point of the cutting edge; uppermost one longest. Mouth-shields longer than broad, five-sided, presenting a rounded angle without; narrower within than without; length to breadth, .6 : .4. Side mouth-shields small, short, irregularly triangular, lying on the sides of mouth-shields, and not meeting within. Under arm-plates a little broader than long, squarish, with rounded corners; near base of arm, touching each other, but not overlapping; length to breadth (sixth plate), .3 : .4; about two thirds out on arm, the plates are nearly separated by side arm-plates, and are pentagonal, with a sharp angle within; lateral sides nearly straight, and

outer side re-enteringly curved; length, .3^{mm}. Side arm-plates with a decided ridge for support of arm-spines, encroaching above, even at base of arm; and below also, farther out on arm. Upper arm-plates much broader than long, pointed oval, more curved within than without, having a slight median ridge; length to breadth (twelfth plate), .3 : .7; about two thirds out on arm, plates broader than long, bounded without by a nearly straight line, within by a strong arch; overlapping each other slightly, and set closer together than those nearer the base of the arm. Disk-scales minute; above, varying somewhat in size, being larger near radial shields; from 144 to 225 to a square *mm*.; below, rather smaller. Radial shields sunken, very long and narrow, joined for their whole length, their inner ends buried in the disk-scales; length to breadth, 1.4 : .2. Arm-spines four, close to the disk five, short, slender, rounded, tapering, sharp, nearly equal; third spine a trifle the longest; length to that of under arm-plate, .4 : .3. Tentacle-scales two, wide, short, thin; the inside one running along lateral side of under arm-plate, the outside one standing at right angles to it. Color, in alcohol: pale brownish.

Variations. — The mouth-shields vary somewhat, but always have an angular, ovoid outline. The living animal has the disk dark gray above, with black radial shields, and a central fawn-colored spot; first three arm-joints edged with black; the rest either black or dark or light gray; along the median line of the arm, above, an interrupted white line. Found at low water, six inches deep in soft mud; it throws up one arm to the surface (Stimpson).

This species is easily told by its immensely long, slender, and even arms, with slim, stout, tapering spines on their sides.

LIST OF SPECIMENS.

Catalogue Number.	Original Number	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
245	..	1	Fort Johnson, Charleston, S. C.	.....	Wm. Stimpson.	Alcoholic.
<i>Smithsonian Institution.</i>						
1029	..	1	South Carolina.	.....	Wm. Stimpson.	Alcoholic.

Amphiura Holbölli LÜTKEN.*Amphiura Holbölli* LÜTKEN. Vidensk. Meddelelser. Nov., 1854.*Amphiura Holbölli* LÜTKEN. Addit. ad Hist. Oph., p. 55.

Special Marks. — Middle mouth-papilla placed higher than the others; one tentacle-scale; under arm-plates pentagonal.

Description of a Specimen. — Diameter of disk, 7.5^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 3.3^{mm}; width of arm without spines, 1.4^{mm}; length of arm, 30^{mm}; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 1.7 : 1.5. Mouth-papillæ, six to each angle of mouth; two innermost stoutest, pointing to centre of mouth, oblong; running upwards to the teeth; innermost papilla attached to side mouth-shield, small, flat, with a curved, cutting edge; middle papillæ placed near the innermost one, and a little higher up; long, sharp, like a canine tooth. Teeth four; two uppermost large, flat, longer than broad, squarish, rather thick; next one smaller, stouter, sharper; lowest one very short and thick, presenting a broad, grinding surface. Mouth-shields rounded, truncated, and narrower without; length to breadth, .7 : .7; madreporic shield nearly twice as large as the rest, and bearing pores on its edge. Side mouth-shields large, broad triangular, with all their sides re-enteringly curved; meeting within, and also meeting their neighbors between the first and second under arm-plates. Under arm-plates about as long as broad, regularly pentagonal, the fifth angle being very obtuse, and directed inwards; length to breadth (thirteenth plate), .6 : .5; first plate nearly hidden by side mouth-shields. Side arm-plates narrow, encroaching so as almost to meet both above and below. Upper arm-plates broader than long, pointed oval, more curved within than without, the inner curve making a faint angle; length to breadth (sixth plate), .6 : 1.2. Disk-scales about 20 to a square *mm*.; some of the primary plates, especially those in the centre, still to be distinguished; scales of interbrachial spaces below much finer. Radial shields small, narrow oval, with inner end pointed; length to breadth, 1.2 : .5; widely separated from each other by a broad wedge of scales. Arm-spines three, near the disk four, nearly equal, stout, nearly cylindrical, blunt, hardly tapering; upper one rather the stoutest and most tapering; lengths to that of under arm-plate (tenth joint), .6 : .6. Tentacle-scale one, small, rounded, standing within the tentacle pore. Color, in alcohol: disk, brownish gray; arms the same, but browner.

Variations.—A small specimen had a disk of 4^{mm}, and arms of 14.5^{mm}; the primary plates were very large, rounded, and distinct; the upper arm-plates were proportionately longer and more angular than in the adult; there were four arm-spines, which were more tapering than in larger specimens. Sometimes the inner angle of the under arm-plates is nearly obliterated. The side mouth-shields often do not quite meet in the interbrachial spaces. Color of the living animal, whitish.

Taken off the coast of Greenland; muddy bottom; fifteen to fifty fathoms (Barrett).

The displaced middle mouth-papilla is a good distinguishing mark in this species.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
236	38	2	Greenland.	.....	University Museum, Copenhagen.	Alcoholic.
<i>Smithsonian Institution.</i>						
1031	..	1	Greenland.	.....	University Museum, Copenhagen.	Alcoholic.

Amphiura Chiajii FORBES.

Asterias filiformis DELLE CHIAJE (*non* O. F. Müller). *Memorie*, II. p. 359. 1825.

Amphiura Chiajii FORBES. *Linn. Trans.*, XIX. p. 151. 1843.

Amphiura Chiajii SARS. *Middelhav. Lit. Fauna*, II. p. 86. 1857.

Amphiura Chiajii LÜTKEN. *Addit. ad Hist. Oph.*, p. 57.

Ophiolepis Sundevalli MÜLL. & TROSC. *Syst. Asteriden*, p. 93.

There are, at Berlin, specimens labelled *Ophiolepis Sundevalli*, apparently in the writing of Joh. Müller (*Anat. Mus.*, 16498). They were sent from Norway by Professor Sars, and are plainly the same as *A. Chiajii*. The two synonymes are contemporaneous; but *A. Chiajii* is here retained as the name in use among the best authors.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
233	36	1	Norway.	.....	University Museum, Copenhagen.	Alcoholic.
234	..	..	.....	.....	Prof. Sars, 1852.	"

***Amphiura geminata* LÜTKEN.**

Ophiolepis geminata LECONTE. Proceed. Phil. Acad., V. p. 317. 1851.

Amphiura (Ophiolepis) geminata LÜTKEN. Addit. ad Hist. Oph., p. 122.

Special Marks.—Arm-spines, near disk, four; the second from below a little rough and somewhat the largest. Lower arm-plates pentagonal.

Description of a Specimen.—Diameter of disk*, 4^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 1.7^{mm}; width of arm without spines, .7^{mm}; length of arm, 35^{mm}; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 1 : .7. Mouth-papillæ, three on each side, in a continuous row; outermost one broader than both the others; two inner ones very small, rounded, bead-like. Mouth-shields longer than broad, shaped like a spear-head, with the point inward; inner lateral sides much longer than outer ones, which are short and re-enteringly curved; length to breadth, .5 : .3; sometimes the mouth-shield is more blunt within. Side mouth-shields proportionately rather large, triangular, not meeting within, sides often a little re-enteringly curved. Under arm-plates broader than long, pentagonal, with an angle turned inward; sides nearly straight, outer corners slightly rounded; nearly, but rarely *quite*, separated by side arm-plates; length to breadth (tenth plate), .3 : .4; first plate rounded, comparatively large; plates at tip of arm shaped much like the basal ones, but more rounded, and inclining to a heart form. Side arm-plates encroaching below pretty equally, from base to end of arm; above, encroaching less. Upper arm-plates regular, broader than long, oval, more curved within than without, and tapering toward each side; length to breadth (eighth plate), .3 : .6. Disk-scales small, even, a little larger near edge

* This measure was taken from one of Dr. LeConte's original specimens, when *dry*; the disk of the living animal probably measured not less than 5^{mm}.

of disk ; about 130 to a square *mm.* ; those below rather smaller. Radial shields narrow, pointed within, with straight sides ; inner ends only separated by a scale, joined for the rest of their length ; length to breadth, .7 : .3. Arm-spines four, a little way out only three ; short, rounded, tapering but slightly, blunt, stout, with a rounded point ; nearly equal, but the two lower ones a trifle longer than the two upper ; the middle spine is stoutest and bluntest of all, and a little rough under the microscope ; length to that of under arm-plate (fifteenth joint), .4 : .3. Tentacle-scales two, standing at right angles to each other ; inside one lying along lateral side of under arm-plate ; the free edges of both curved. Color, dry : disk, above, white, arms faded neutral tint ; below, much paler.

Variations. — The mouth-shields may be proportionately longer and sharper, or shorter and blunter. The arms above may be irregularly banded with lighter. Dr. LeConte gives the color as “pale gray, arms marked with scattered brown spots.”

This species is distinguished from *A. occidentalis* and from *A. atra* by the different forms of the under arm-plates and mouth-shields.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
244	1199	1	Panama.	| . . . . .	Dr. J. LeConte.	Dried.
<i>Smithsonian Institution.</i>						
1199	..	2	Panama.	| . . . . .	Dr. J. LeConte.	Dried.

Amphiura squamata Sars.

- Asterias squamata* DELLE CHIAJE, *Memorie*, III. p. 77. 1828.
Ophiura neglecta JOHNSTON. *Mag. Nat. Hist.*, p. 467. 1835.
Ophiocoma neglecta FORBES. *Brit. Starfishes*, p. 30. 1841.
Ophiolepis squamata MÜLL. & TROSCHE. *Syst. Asteriden*, p. 92. 1842.
Ophiolepis (Amphiura) squamata Sars. *Middelhav. Lit. Fauna*, II. p. 84. 1857.
Ophiolepis tenuis AYRES. *Proceed. Boston Soc. Nat. Hist.*, IV. p. 133. 1852.
Amphiura tenuis LYMAN. *Proceed. Boston Soc. Nat. Hist.*, VII. p. 194. 1860.

Special Marks. — Arms from two and a half to four and a half times the diameter of the disk. Three regular, tapering, blunt spines ; the two lowest equal, the uppermost a little stouter.

Description of a Specimen.—Diameter of disk, 4.5^{mm} ; from outer side of mouth-shield to outer corner of opposite mouth-slit, 1.7^{mm} ; width of arm without spines, $.6^{mm}$; length of arm, 19^{mm} ; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, $.8 : .7$. Mouth-papillæ regular, stout; three on each side; outer one longer than inner ones, and about twice as wide; two inner ones of about equal size, nearly square, with corners rounded; the innermost one runs upward to the teeth. Teeth five, flat, thin, squarish; lowest one smallest and most pointed; uppermost one a good deal the largest. Mouth-shields broad heart-shaped, with a sharp point within; rather small; length to breadth, $.3 : .4$. Side mouth-shields comparatively stout and large, meeting within. Under arm-plates shield-shaped, having an angle within, the outer side nearly straight, and lateral sides a little re-enteringly curved; outer corners rounded; length to breadth (sixth plate), $.3 : .3$; even the plates at the base of the arm are separated by the side arm-plates; first plate diamond-shaped, very small. Side arm-plates encroaching more below than above. Upper arm-plates rounded; outer side nearly straight; inner and lateral sides included in a common curve; all are slightly separated by the encroachment of the side arm-plates, except one or two at the base of the arm; length to breadth (third plate), $.4 : .5$. Disk-scales of pretty even size above and below, the latter considerably smaller; above, about 25 to a square *mm*. Radial shields joined for their whole length; shaped somewhat like a slender pear-seed, but with the inside edge straight; their two sharp ends are separated within by a single small scale; length to breadth, $.9 : .3$. Where the scales of the under surface meet those of the upper, there is a distinct line, made by the upturned edges of the lower scales. Arm-spines three, short, stout, of equal length, a little rounded and flattened, even, tapering, blunt; upper one broadest and stoutest; second, third, and fourth joints, only two spines, which are stouter and more rounded. Tentacle-scales two, rather short and broad, with a strongly curved, free edge; standing to each other at an angle somewhat less than a right angle. Color, in alcohol: nearly white.

Variations.—The disk may be to the arms as $3.6 : 10$, or $4.7 : 16.5$. The mouth-shields vary in breadth. There are sometimes four arm-spines on one or two basal joints. *A. squamata* has been dredged in from three to six fathoms, and is found creeping over shells and stones. When alive, its color is dark grayish-brown, with radial shields lighter (Ayres). It stands very near to *A. tenera* and *A. pugetana*, but the former has the middle arm-spine thickened at its base, and the latter has arms about twice as long; *A. Puntarenæ* has a notch in the outer side of the lower arm-plate, *A. microdiscus* has differently shaped upper arm-plates, and *A. violacea* has much smaller mouth-shields.

This widely-spread little creature, extending from the Mediterranean on the east, to Massachusetts Bay on the west, possesses a high interest as being *viviparous*, a fact first noticed by Professor De Quatrefages (Comptes Rendus de l'Academie, XV. p. 799, 1842), and afterwards more fully treated by Dr. Schultze (Müller's Archiv., p. 37, 1852). I myself found a good number, during the month of June, in the basin of Arcachon, south of Bordeaux. They lived just below low-water-mark, among bits of broken shell. On being captured, the gravid individuals would often cast off their disk, from which would wriggle out numerous orange-colored young!

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
242	68	1	Oresund.	.....	University Museum, Copenhagen.	Alcoholic.
240	..	2	Bird Isl., Bost. Harbor.	.....	Prof. Agassiz.	"
241	..	4	.....	.....	Prof. Agassiz.	"
377 & 378.	Nahant, Mass.	.....	.....	"
<i>Smithsonian Institution.</i>						
1060	..	2	Massachusetts Bay.	.....	Wm. Stimpson.	Alcoholic.
1047	..	2	Grand Manan Island.	.....	Wm. Stimpson.	"

Amphiura tenera LÜTKEN.

Amphiura tenera LÜTKEN. Addit. ad Hist. Oph., p. 124.

Special Marks.—Length of arm usually about four times the diameter of the disk. Middle arm-spine swelled at the base.

Description of a Specimen.—Diameter of disk, 3.2^{mm}.; from outer side of mouth-shield to outer corner of opposite mouth-slit, 1.3^{mm}.; width of arm without spines, .4^{mm}.; length of arm, 10.5^{mm}.; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, .6 : .6. Mouth-papillæ, three on each side; outermost one wider than both the others together, flat, with a curved, cutting edge; two inner ones separated, nearly equal, small, rounded, bead-like; innermost one of all running upwards to the teeth. Teeth four, longer than broad; two uppermost ones flat, squarish, thin; two lowermost the same, but more rounded, tapering, and pointed. Mouth-shields heart-shaped, with straight sides, and a sharp point turned

inward; length to breadth, .3 : .3. Side mouth-shields proportionately very large, meeting within, shaped like regular wedges, with the broad end out. Under arm-plates a trifle longer than broad, shield-shaped, with an angle within; outer side nearly straight, lateral sides a little re-enteringly curved, outer corners rounded, length to breadth (sixth plate) about .3 : .3. Side arm-plates encroaching above and below, so as to separate both upper and under arm-plates. Upper arm-plates with outer side slightly curved; inner and lateral sides included in a common curve, which has the form of an arch; length to breadth (third plate) about .3 : .4. At the tip of the arm, the joints are much longer than broad, wide without, but greatly constricted within; they are embraced by the side arm-plates, the upper and under plates being small in size, and occupying the outer end of the joint. Disk-scales pretty regular and even; above, about 36 to a square *mm.*; below, considerably smaller; along the margin of the disk, the free edges of the lower scales make a distinct line. Radial shields shaped like elongated pear-seeds, with one side nearly straight; joined for their whole length, except their inner points, which are separated by a single scale; length to breadth, .7 : .2. Arm-spines three (close to disk sometimes an additional one above); uppermost and lowest nearly equal, short, rounded, a little flattened, tapering, rather sharp; lengths to that of under arm-plate, .3 : .3; middle one a trifle shorter, rounded, not flattened, swelled at the base, and contracting suddenly to a point. Close to tip of arm, there are two or three spines, of which the lowest is longest; they are sharper and more elongated than those near base of arm. Tentacle-scales two, of moderate size, standing partly erect, and at an angle to each other. Color, in alcohol: nearly white, with faint traces of brownish on disk.

Variations.—The disk may be to the arms as 3 : 12, 2.7 : 10, or 2 : 6.6. Otherwise the specimens vary scarcely at all. A young one, with a disk of 2^{mm.}, had the under arm-plates proportionately longer, and the side arm-plates more developed; the disk-scales were in like manner larger, and the primary plates more conspicuous.

A. tenera is distinguished from *A. squamata* and *A. pugetana* by its swollen middle arm-spines; from *A. Örstedii*, *A. violacea*, and *A. microdiscus*, by different upper arm-plates; and from *A. Puntarenæ* by wanting a notch in the lower arm-plates. It has been taken at St. Thomas in four fathoms (*A. H. Rüse*).

LIST OF SPECIMENS.

Catalogue Number.	Original Number	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
237	67	2	West Indies.	.....	University Museum, Copenhagen.	Alcoholic.
238	..	2	Charleston, S. C.	.....	Prof. Agassiz.	"
239	1113	2	St. Thomas, W. I.	.....	A. H. Riise.	"
<i>Smithsonian Institution.</i>						
1113	..	6	St. Thomas, W. I.	.....	A. H. Riise.	Alcoholic.

Amphiura pugetana LYMAN.

Amphiura pugetana LYMAN. Proceed. Boston Soc. Nat. Hist., VII. p. 193.

Special Marks. — Arms long; often eight times the diameter of the disk; a light line running along their upper side.

Description of a Specimen. — Diameter of disk, 3.5^{mm}; from outer edge of mouth-shield to outer corner of opposite mouth-slit, 1.5^{mm}; greatest width of arm without spines, .7^{mm}; length of arms, 24.5^{mm}; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, .6 : .5. Teeth four, stout, flat, rather thick, squarish, with cutting edge curved. Mouth-shields nearly diamond-shaped, the outer and side angles slightly rounded; length to breadth, .3 : .2. Side mouth-shields large, thick, and somewhat swelled; meeting within, closely joined to surrounding parts. Under arm-plates five-sided, with the fifth angle directed inward; length to breadth, near base of arm, .5 : .4. Side arm-plates strong and well developed, meeting above and below. Upper arm-plates bounded within by a strong arch, without by a slight curve; their lateral sides short; length to breadth, near base of arm, .5 : .7; they do not quite touch each other. Scales of disk mostly rounded, smaller below than above; those above of pretty even size, with a few little ones; near edge of disk, about 50 to a square *mm.*; those toward the centre larger. Radial shields closely joined for their whole length, oval, with the inner end pointed; length to breadth, .7 : .3. Arm-spines three, sometimes four on joints close to disk; evenly tapering, moderately stout, of even lengths; length near disk, .5^{mm}. Tentacle-scales two, small and rounded, placed obliquely side by side. Color, in alcohol: disk, above, light

greenish-gray; below lighter, radial shields darker; arms, above and below, straw-color, with a faint white line running lengthwise above.

Variations.—The angles of the mouth-shields may be more or less rounded. Among younger specimens the scales of the disk are more even in size, and the primary plates have their corners not entirely rounded off. The proportion of the arms to the disk varies somewhat; thus: diameter of disk to length of arms as 3.5 : 24.5, 3 : 21, or 2.5 : 22.5.

This species is distinguished from others of the genus as follows: *A. Örstedii* has the radial shields longer, and separated a part of their length; four or five spines and upper arm-plates broader. *A. Punta-reneæ* has rather longer arms, a small notch in the outer side of the under arm-plates, and the upper arm-plates regularly oval. *A. violacea* has mouth-shields proportionately much smaller, and the arms shorter; the color must also be quite distinct. *A. microdiscus* has, even in small specimens, the upper arm-plates touching each other, and twice as broad as long. *A. tenera* has the middle arm-spine swelled at the base. *A. squamata* stands very near the present species; but the arms, in specimens of the same size, are not more than half as long.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
231	..	12+	Mendocino, Cal.	.....	Alex. Agassiz.	Alcoholic.
232	1057	1	Puget Sound.	.....	Dr. Kennerly.	"
380	California.	.....	.....	"
<i>Smithsonian Institution.</i>						
1053	..	1	Puget Sound.	.....	Dr. Kennerly.	Alcoholic.
1057	..	2	Puget Sound.	.....	Dr. Kennerly.	"
1037	..	1	Puget Sound.	.....	Dr. Kennerly.	"

Amphiura atra LÜTKEN.

Ophiopsis atra STIMPSON. Proceed. Boston Soc. Nat. Hist., IV. p. 225. 1852.

Amphiura (Ophiopsis) atra LÜTKEN. Addit. ad Hist. Oph., p. 118.

Special Marks.—Three arm-spines; under arm-plates narrower without than within, their outer side re-enteringly curved; mouth-papillæ making a connected line; innermost pair running upwards to the teeth.

Description of a Specimen.—Diameter of disk, 9.5^{mm.}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 3.6^{mm.}; width of arm without spines, 2^{mm.}; length of arm about 95^{mm.}; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 1.6 : 1.6. Mouth-papillæ wide, somewhat angular, applied end to end, so as to form a connected line; innermost pair extending upwards towards the teeth, and thus partly holding the place of tooth-papillæ; usually six, sometimes eight, to each angle of the mouth. Teeth nine; lowest one small, irregular, often broken in two or three pieces; the rest squarish, flattened, very regular, increasing a little in size towards the upper ones. Mouth-shields small, diamond-shape, longer than broad; length to breadth, 1 : .6; madreporic shield larger and swollen. Side mouth-shields comparatively large, meeting within, broader without than within, and with a slight curve like an *S*. Under arm-plates broader than long, broader within than without; inner and lateral sides nearly straight, outer side re-enteringly curved, corners rounded; length to breadth (seventh plate), .5 : .8; the plates are in contact only at the base of the arm; about the twelfth plate they begin to be separated by the side arm-plates, and begin also to have a slight peak on their inner side, which is the point of juncture of two slightly curved inner laterals; the first plate is quite rudimentary. Side arm-plates rather feeble, long, encroaching above and below, having a very small ridge for spines. Upper arm-plates much broader than long, pointed oval, with outer side nearly straight, and inner sides curved; separated from each other except on the middle line; length to breadth (tenth plate), .6 : 1.7. Disk with closely overlapping scales, about 36 to a square *mm.*; below finer; near radial shields larger; from near the outside corner of the radial shields runs a single straight row of larger scales, passing diagonally over the edge of the disk. Radial shields rather large, irregular oval, with a point within, united without, within separated by a group of scales; length to breadth, 2 : .9. Arm-spines short, round, tapering, sharp; lengths of two lower ones to that of under arm-plate, near base of arm, .9, .9 : .5; upper one somewhat shorter. Tentacle-scales two, broad, short, erect, with a

curved edge, and standing nearly at right angles to each other, the inside one running along the lateral side of the under arm-plate. Color, in alcohol: nearly uniform faded gray.

Variations.—Another specimen of about the same size had the scaling of the disk somewhat finer, and the radial shields almost as wide as long. Mr. Stimpson says that the disk of the living animal is lobulate, and very soft. The creature is of a very dark-gray color, nearly black, except the white madreporic shield; the arms jet black above, except at their extremities. It lives at low water, buried in the mud.

This species is pretty distinct from other *Amphiuræ*, and has some resemblance to *Hemipholis*. It seems to stand nearest to *A. Rusei*, from which, however, it differs in having longer arms, separated under arm-plates, sharper arm-spines, &c.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
246	..	1	Fort Johnson, Charleston, S. C.	.....	Wm. Stimpson.	Alcoholic.

***Amphiura urtica* LYMAN.**

Amphiura urtica LYMAN. Proceed. Boston Soc. Nat. Hist., VII. p. 195. 1860.

Special Marks.—Some of the disk-scales bearing fine prickles on their edges. Arm-spines sharp, rounded, tapering.

Description of a Specimen.—Diameter of disk, 6^{mm.}; outer side of mouth-shield to outer corner of opposite mouth-slit, 2^{mm.}; width of arm without spines, .8^{mm.}; length of arms about eleven times diameter of disk (a specimen having a diameter of disk 5.5^{mm.}, had 55^{mm.} length of arm); distance from outer edge of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 1:1. Mouth-papillæ rounded and bead-like, three on each side. Teeth six, rather irregular, three upper ones largest, stout, longer than broad, thickened; two next smaller and more pointed; lowest one very short and swollen, like a tooth-papilla. Mouth-shields nearly square, with an

angle directed inward; outer angle truncated, and making a slight peak; other angles slightly rounded; length to breadth, .5:.5. Side mouth-shields not meeting within. Upper arm-plates irregular oval, outer side less curved than inner side; length to breadth, .5:.7. Under arm-plates scarcely touching each other; inner one five-sided, the rest nearly square, with a strong notch in the outer side; length to breadth, .4:.4. Scales of disk fine and even, about 140 to a square *mm.*; some of those near margin of disk bearing very fine prickles on their edges. Primary plates not conspicuous. Radial shields elongated oval, tapering within, joined for their whole length; length to breadth, 1:.5. Arm-spines three, about as long as the joints, delicate, sharp, regularly tapering. Tentacle-scales two, both of them small and delicate. Color, in alcohol: upper and under surface of disk dark greenish-gray, with a margin of light; arms light straw-color.

Variations.—The mouth-shields vary in shape to an unusual degree; sometimes they have a strong peak without, and again none at all; they may be nearly rectangular, or almost oval, and some are not far from round. The under arm-plates may be more or less pentagonal; but, in the adult, most of them are nearly square. The young, with a disk 2.5^{mm.} in diameter, have the under arm-plates pentagonal, with a deep notch in their outer side, and separated by the side arm-plates; they have also, on the back of the disk, a conspicuous rosette of round primary scales.

This species differs from *A. occidentalis* in its notched under arm-plates, sharp spines, and prickly scales of the disk. It is a somewhat aberrant species, and by its prickly scales approaches *Ophiocnida scabriscula*.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy</i>						
243	1056	1	Puget Sound.	.....	Dr. Kennerly.	Alcoholic.
<i>Smithsonian Institution.</i>						
1056	..	5	Puget Sound.	.....	Dr. Kennerly.	Alcoholic.
1041	..	6	Puget Sound.	.....	Dr. Kennerly.	"

Amphiura occidentalis LYMAN. (Figs. 12, 13.)

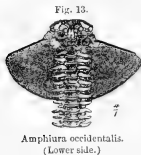
Amphiura occidentalis LYMAN. Proceed. Boston Soc. Nat. Hist., VII. p. 194. 1860.

Special Marks.—Mouth-papillæ of nearly equal size. Arm-spines very blunt, and pretty stout. Arms long, flat, broad.

Description of a Specimen.—Diameter of disk, 5.8^{mm}.; outer edge of mouth-shield to outer corner of opposite mouth-slit, 2.2^{mm}.; greatest width of arm without spines, 1.3^{mm}. As the arms were somewhat broken, their length could not well be measured; but, from their proportions, they must have been at least eight times the diameter of the disk. Distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 1.2 : 1. Mouth-papillæ rounded; innermost one stoutest, and pointing to centre



of mouth. Teeth five; four upper ones flat, square, the second from the top largest; lowest one of all smallest, very short, thick, and rounded, somewhat like a tooth-papilla. Mouth-shields small, oval diamond-shaped, the angles being so rounded as to give almost a true oval; outer angle making a very slight peak; length to breadth, .4 : .5. Side mouth-shields not meeting within. Under arm-plates square oblong; angles somewhat rounded; outer side with a slightly re-entering curve; second plate differs from the rest, being five-sided, with its fifth angle directed inward; it is separated from the rudimentary first plate by narrow prolongations of the side arm-plates. The next three or four plates are in like manner separated, while those farther out on the



arm are close together, which is an inversion of the usual order. Length of plates to breadth, .4 : .4. Upper arm-plates oblong, with rounded corners; outer side with a slightly re-entering curve; length to breadth, .5 : 1. Scales of disk fine, smooth, and even, above and below; about 60 to a square *mm*.; primary plates distinguished by greater size. Radial shields shaped like an elongated, blunt pear-seed; separated by a narrow, single line of scales; length to breadth, 1.1 : .4. Arm-spines three, not tapering, rather stout, rounded at the end, flattened, about as long as the joints. Two small, rounded tentacle-scales. Color, in alcohol: disk, above, faint greenish-gray; arms and under surface straw-color.

Variations.—The mouth-shields may be quite oval; the second under arm-plate, instead of being five-sided, may resemble the rest.

This species is distinguished from *A. geminata* by the shape of the mouth-shields and of the upper and lower arm-plates, and in having the mouth-papillæ of the same size; from *A. chilensis*, by having two tentacle-scales instead of one.

No. 1063 is from Puget Sound, and may be another species. The spines are blunter, the under scales of the disk larger and less crowded, and the under arm-plates rather more rounded. More specimens will settle the question.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
379	California.	.....	.....	Alcoholic.
229	..	12+	Mendocino, Cal.	.....	Alex. Agassiz.	"
230	1054	1	Monterey, Cal.	.....	Mr. Sayla.	"
354	..	1	Gulf of Georgia.	.....	Alex. Agassiz.	"
<i>Smithsonian Institution.</i>						
1063	..	1	Puget Sound.	.....	Dr. Kennerly.	Alcoholic.
1054	..	3	Monterey, Cal.	.....	Mr. Sayla.	"

OPIHOPHRAGMUS* LYMAN.

Disk small and delicate, furnished with uncovered radial shields, and covered with naked scales; the scales along the edge of the disk are turned up, so as to make a little fence. Teeth. No tooth-papillæ. Six mouth-papillæ to each angle of the mouth. Arms slender, even, more or less flattened. Arm-spines short and regular, arranged along the sides of the side arm-plates.

* *Ophis*, snake; *φραγμός*, hedge.

Ophiophragmus Wurdemanii LYMAN.

Amphiura Wurdemanii LYMAN. Proceed. Boston Soc. Nat. Hist., VII. p. 196.

Special Marks.—Disk-scales smooth, and not regularly arranged. Mouth-shields long and narrow.

Description of a Specimen.—Diameter of disk, 9.5^{mm}.; from outer edge of mouth-shield to outer corner of opposite mouth-slit, 3.5^{mm}.; width of arm without spines, 2.2^{mm}. Arms remarkably flat, wide, and little tapering; as they were broken, the length could not be known, but it seemed not less than ten times the diameter of the disk. Distance from outer edge of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 1.6 : 1.5. Mouth-papillæ, three on each side, rounded and bead-like; innermost one placed below the teeth, and running somewhat upward. Teeth broad and flat, with free edge a little curved. Mouth-shields shaped something like the sole of a shoe, very long and narrow, small, with their outer end rounded, and their inner one a rounded point, wider within than without; length to breadth, .8 : .5. Side mouth-shields almost as large as mouth-shields proper, meeting within, somewhat curved. Under arm-plates squarish, rather broader than long, overlapping each other a little; outer side bounded by a slightly re-entering curve, corners rounded; length to breadth (thirteenth plate), .5 : .7. Upper arm-plates very short and broad, overlapping, bounded without by a re-entering curve; outer corners strongly rounded; length to breadth, .4 : 1.7; they are occasionally broken in two. Scales of disk fine, of pretty even size, rather thicker than are usually found in the genus, about 16 to a square *mm*.; those below somewhat finer. Radial shields broad, blunt, pear-seed shaped, sometimes separated by a wedge of three or four scales, sometimes joined by their sides; length to breadth, 2 : 1. Arm-spines three, short, stout, broad, rounded at the end, somewhat flattened, a little longer than joints, nearly alike in shape and size. Tentacle-scales two, short, broad, and thin, with curved edges. Color, in alcohol: above, disk nearly white; arms straw-color, with irregular bands of dark brown; below, arms straw-color, interbranchial spaces white, mouth-shields brown.

This species belongs with those *Amphiuræ* that have the upper row of the lower scales of the disk strongly developed and standing upright, thus making a sort of fence. It differs from *O. septa** in the shape of the mouth-shields, and in wanting spines on the upper surface of the

* *Amphiura septa* Ltk. and *A. marginata* Ltk. plainly belong in this genus.

disk; from *O. marginata*, in the irregular arrangement of the disk-scales, the different proportions of the arm-plates, &c.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
251	. .	1	Charlotte's Harbor, Florida.	. . . . .	G. Wurdeman.	Alcoholic.

OPHIOCNIDA* LYMAN.

Disk small and delicate, furnished with uncovered radial shields; its coat of naked, overlapping scales, is beset with small thorns. Teeth. No tooth-papillæ. Six mouth-papillæ to each angle of the mouth. Arms slender, even, more or less flattened. Arm-spines short and regular, arranged along the sides of the side arm-plates. Two genital slits to each interbrachial space.

SPECIES HEREIN DESCRIBED.

O. hispida. *O. scabriuscula.* *O. neapolitana.*

Ophiocnida hispida LYMAN.

Ophiopsis hispida LeConte. Proceed. Phil. Acad., V. p. 318. 1851.

Amphiura (Ophiopsis) hispida Lütken. Addit. ad Hist. Oph., p. 119.

Special Marks. — Disk gray (in alcohol); arms straw-color, figured with black. Arms to disk as about ten to one. Under arm-plates squarish, but little broader than long.

* *Οφίς, snake; κνίδη, nettle.

Description of a Specimen.—Diameter of disk, 9^{mm} ; from outer side of mouth-shield to outer corner of opposite mouth-slit, 3.3^{mm} ; width of arm without spines, 1.6^{mm} ; length of arm, 95^{mm} ; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, $1.5 : 1.5$. Mouth-papillæ, three on each side; two outer ones like short, stout, conical, rounded tubercles; innermost one much the largest; rounded, flattened, swollen; situated higher than the other two, and running upwards to the teeth; resembling a tooth-papilla. Teeth four, lowest one smallest, variable in size, usually broader than long, very thick and rounded, sometimes split in two; second one longer than broad, very stout, nearly cylindrical; third tooth similar, but rather more flattened; uppermost one longest, stout, thick, flattened. Mouth-shields small, short, diamond-shaped, with rounded angles, and sides sometimes straight and sometimes a little curved; length to breadth, $.8 : .7$. Side mouth-shields small, triangular, somewhat variable, not meeting within. Under arm-plates very regular, squarish, broader than long, with lateral sides nearly straight, outer and inner sides a little curved, and corners rounded; first five or six plates gradually increasing in size, but all of them smaller and proportionately narrower than those beyond; first plate larger than is usual in allied species, corners quite rounded off; length to breadth, $.2 : .4$; third plate a trifle wider without than within, lateral sides a little re-enteringly curved, inner side nearly straight; length to breadth, $.4 : .5$; twentieth plate typical; length to breadth, $.5 : .7$. Side arm-plates encroaching a little above, but not at all below, even at tip of arm. Upper arm-plates much broader than long; outer side nearly straight, with a slight notch in the middle, lateral and inner sides curved, outer corners cleanly rounded; length to breadth (twentieth plate), $.5 : 1.3$. Disk-scales rather thick for their size, largest near radial shields on the centre of the upper surface, about 70 to a square mm .; below, somewhat smaller and more even. The scales are considerably obscured by a pretty thick growth of short, slender, sharp thorns, about $.2^{\text{mm}}$ long; they are everywhere, except on the radial shields, and a bare stripe below, running along each genital slit; the thorns are stouter near the radial shields. Radial shields small, narrow, tapering inward, separated by a strip of thorny scales; length to breadth, $1.8 : .5$. Arm-spines three, short, blunt, cylindrical, a little tapering, of nearly equal lengths; lengths to that of under arm-plate (twelfth joint), $.6, .6, .6 : .5$. Tentacle-scales two, wide, short, thin, with a curved free edge, standing at right angles to each other, the inside one running along the lateral side of the under arm-plate. Color, in alcohol: above, disk dull bluish-gray (clay color); arms straw, with irregular bands and patches of black; below, interbrachial spaces same as upper surface; mouth-parts nearly white; under arm-plates brownish, fading to straw-color farther out on

arm. According to Dr. LeConte, the color of the living animal would seem to be the same.

Variations. — Dr. LeConte's original specimen has the outer side of the upper arm-plates rather more curved, and almost without any notch.

O. hispida differs from *O. scabriuscula* in having narrower under arm-plates, rather longer arms, and longer and sharper spines on the disk; the markings, also, are black, instead of light green.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
251	1052	1	Panama.	.....	Rev. T. Powell.	Alcoholic.
381	..	..	Panama.	.....	Dr. Sternberg.	"
<i>Smithsonian Institution.</i>						
1052	..	2	Panama.	.....	Rev. T. Powell.	Alcoholic.
1197	..	1	Panama.	.....	Dr. John LeConte.	Dried.

Ophiocnida scabriuscula LYMAN.

Amphiura scabriuscula LÜTKEN. Addit. ad Hist. Oph., p. 118. 1859.

Special Marks. — Arms six to eight times the diameter of the disk. Small and very short spines on the disk. Arm-spines flattened.

Description of a Specimen. — Diameter of disk, 8.5^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 3.2^{mm}; width of arm without spines, 1.5^{mm}; length of arm, 52^{mm}; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 1.7 : 1.5. Mouth-papillæ, six to each angle of the mouth, small, rounded, separated, slightly flattened, nearly equal, the innermost pair standing a little higher up than the others, and running upwards to the teeth. Teeth four; upper one much the largest, long, flat, moderately thick, with a slightly curved cutting edge; two next smaller, narrower, stouter, more rounded, with the edge thickened at its middle point; lowest one shaped like a broad, rounded, swelled tubercle. Mouth-shields longer than broad, rounded within, prolonged without, in a tail-like projection, inner end terminating in a rounded

point; length to breadth, .9 : .7. Side mouth-shields small, slender, not meeting within. Under arm-plates squarish, separated by a narrow line, broader without than within, inner side slightly curved, outer side nearly straight, lateral sides re-enteringly curved, outer corners projecting; length to breadth (tenth plate), .4 : .6. Upper arm-plates covering whole upper surface of arm, much broader than long, a little overlapping; outer side with a slight re-entering curve in the middle, lateral sides cleanly rounded; length to breadth (twelfth plate), .4 : 1.5. Spines of the disk minute, somewhat larger and more plenty near the edge of the disk, and smaller and fewer towards the centre and in the interbrachial spaces below; the largest are only about .1^{mm} in length; disk-scales in the centre, and in the interbrachial spaces below, hidden by epidermis; towards the margin they appear rather stout. Radial shields elongated oval, blunt at both ends, touching each other at their outer tips, and then suddenly diverging, the space between them being filled by a group of small scales; length to breadth, 1.6 : .6. Arm-spines three, blunt, rather stout, flattened, hardly tapering, of nearly equal size; lengths to that of under arm-plate (eleventh joint), .6 : .4. Tentacle-scales two, small, but rather thick, standing at right angles to each other, the one lying along the lateral side of the under arm-plate shorter than its neighbor. Color, in alcohol: above, disk, near edges, pale greenish, with a central patch and five radiating lines of yellowish brown (yellow ochre); arms also yellowish-brown, but browner than the tint on the disk; below, coloration the same, without any pale green. Lütken gives the color as pale yellow, with some green bars on the arms.

This species is distinguished from *O. hispida* by shorter arms, and shorter spines on the disk.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
250	58	1	West Indies.	.....	University Museum, Copenhagen.	Alcoholic.

Ophiocnida neapolitana LYMAN.

Amphiura neapolitana SARS. Nyt Magazin for Naturvidenskaberne, X. p. 35. 1857.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
416	Alger.	.....	Jardin des Plantes.	Alcoholic.

HEMIPHOLIS AGASS. MS.

Disk, above, covered with rounded, rather thick scales, and with large radial shields; below, naked. At the base of each arm, disk slightly indented. Teeth. No tooth-papillæ. Two mouth-papillæ to each angle of the mouth. Side mouth-shields touching each other, so as to form a continuous ring round the mouth. Three short, tapering arm-spines. Two genital slits, beginning outside the mouth-shields.

Hemipholis cordifera LYMAN. (Pl. I. Figs. 1-3.)

Asterias cordifera BOSCH. Hist. Nat. des Vers, II. p. 113 (1802), II. p. 133 (1830).

Ophiura elongata SAY. Journ. Phil. Acad., V. p. 146. 1825.

Ophiolepis elongata STIMPSON. Proceed. Boston Soc. Nat. Hist., IV. p. 225.

Ophiolepis uncinata AYRES. Proceed. Boston Soc. Nat. Hist., IV. p. 250.

Hemipholis elongata AGASS. MS.

Amphiura elongata LÜTKEN. Addit. ad Hist. Oph., p. 115.

Amphiura cordifera LYMAN. Proceed. Boston Soc. Nat. Hist., VII. p. 258.

Special Marks. — Arms eight or nine times as long as diameter of disk. One tentacle-scale. Three or four papillæ at base of arms; and a row of fleshy papillæ along genital slits.

Description of a Specimen. — Diameter of disk, 8.3^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 3^{mm}; width

of arm without spines, 1.7^{mm} ; length of arm, 81^{mm} ; distance from outer side of mouth-shields to inner points of teeth, to that between outer corners of mouth-slits, $1.6 : 1.8$. Mouth-papillæ small, flattened, rounded, situated at the very base of the jaw-frames. Teeth nine, blunt, squarish, much thickened at the middle point of their cutting edge; uppermost one sharp, and much longer than the rest; lowest one projecting less inward than the others. Mouth-shields irregular oval, more strongly curved without; length to breadth, $.6 : .9$. Side mouth-shields long, narrow, meeting within. Under arm-plates regular, broader than long, with rounded corners, so as to be nearly oval; length to breadth (twenty-fourth plate), $.6 : 1$. As the side mouth-shields meet on the middle line of the arm, the first under arm-plate is reduced to a little papilla at the outer corner of the mouth-slit. Side arm-plates small, with but a small ridge; encroaching slightly on upper arm-plates. Upper arm-plates much broader than long, outer side nearly straight, and broader than the inner; lateral corners ending in a rounded point; length to breadth (twelfth plate), $.6 : 1.5$; the first two or three plates are enclosed by the notch in the disk, and are rudimentary. Scales of disk small, rather thick, more or less rounded; among them may be distinguished the primary plates; on the middle line of each interbrachial space is a raised, radiating row of scales, each overlapped by its predecessor, but with its other edges free; on either side of this row the scales are smaller, and overlap each other like those of a fish. Radial shields pear-seed shaped, with the point inward; large; length to breadth, $1.9 : 1.2$; set back a little from the margin of the disk, separated by a wedge of three scales, whereof the outer is long and narrow, the inner nearly round, and the middle one intermediate; on each side of the notches in the disk, three or four little, slender papillæ, like small arm-spines. The scaly coat extends over the disk margin, and there ceases abruptly. Under surface covered with a naked, somewhat wrinkled skin; along edges of genital slits a row of small, tapering, fleshy papillæ. Arm-spines equal, rounded, tapering, sharp; lengths to that of under arm-plate, $.7, .7, .7 : .6$. Tentacle-scale one, small, flat, a little longer than broad, rounded, standing well clear of lower arm-plate. Color, in alcohol: above, ground color greenish gray (sap-green and neutral tint), radial shields and some of the disk-scales much lighter; arms rather darker than disk, growing lighter towards their tips, but banded with dark rings, each including one or two joints; below, interbrachial spaces brownish flesh-color; under arm-plates same color as upper surface, but much paler; arm-spines nearly white.

Variations.—According to Professor Agassiz's colored drawings, the tints vary very much; the ground color of the disk may be dull indigo-blue, various shades of greenish, yellowish brown, yellow, gray, or

brownish flesh-color; the radial shields are usually different from the disk, and may be bright or dull green, dark brown, lake-red, bluish, dull brown, or gray; the arms also commonly differ from the disk, and are commonly banded; one specimen had them sap-green, another lake-red, and a third brownish flesh-color, banded with black. The disk seems never to be uniform, but always speckled or mottled with two or more colors. The tentacles are red. In other respects this species seems to be singularly uniform. The young, when very small, differ extremely from the adult; they are found clinging to the arms and disk of the parent. A specimen with a disk of .5^{mm}, had arms 1.3^{mm} in length, and with eight joints; the whole upper surface of the disk was occupied by six primary plates, of which the middle one was regularly pentagonal, the other five surrounding it regularly hexagonal; the upper arm-plates were reduced to a small oval plate at the outer end of each joint, while most of the upper surface was occupied by the side arm-plates, which met along the middle line; they met also below, but the under arm-plates were longer than the upper, and had the form of a long, sharp wedge, with the outer side a little curved; the arm ended in a three-lobed papilla, evidently the beginning of a new joint; the arm-spines were only two in number, and the lower one had two or three hooks along its edge; the mouth occupied more of the under surface than in the adult; on each side of the mouth-shields appeared a squarish papilla (side mouth-shields); the jaw, with its three teeth, was prominent, and outside of it were the two mouth-papillæ, already well formed. Another young one, with a disk of 1^{mm}, showed already great advancement; the arms were 7.3^{mm} long, and had twenty-two joints; the upper arm-plates were large and heart-shaped, with the point inward, resembling much the adult shape of *Amphiura tenera*; the under arm-plates were long, with straight outer and lateral sides, and an angle within; the side arm-plates had become much more restricted; there were three arm-spines, rather blunter than those of the adult; only at the tip of the arm did the lowest spine have hooks; the mouth-parts were nearly as in the grown animal, but with wider mouth-shields; the whole centre of the upper disk surface was still occupied by six primary plates, but, in addition, there was a radiating row of three primary plates in each interbrachial space, and in each brachial space a single additional plate, between which and the base of the arms were the beginnings of two radial shields; all these plates were connected, and made an elegant mosaic; in the grown animal they may be recognized by their greater size, but they are then quite separated by numerous smaller scales. A specimen with a disk of 2.3^{mm} had the primary plates a good deal rounded; the radial shields were fully formed, and a few of the smaller scales had begun to appear.

This species "is gregarious, living in companies of twenty or thirty.

The existence of these groups is indicated at low water, by spaces of about a foot in diameter, covered with small holes, looking very much as if a charge of shot had been fired into them. If these spots are watched as the tide rises, from each hole an arm of one of the starfishes will be seen to protrude, and wave about in the water. Generally each individual sends up one of its rays in this manner" (Stimpson).

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
199	..	12+	Charleston, S. C.	.....	Prof. Agassiz.	Alcoholic.
200	..	12+	Charleston, S. C.	1852.	Prof. Agassiz.	"
201	..	12+	Charleston, S. C.	1852.	Prof. Agassiz.	"
202	..	12+	Charleston, S. C.	1852.	Prof. Agassiz.	"
<i>Smithsonian Institution.</i>						
1009	..	12+	South Carolina.	.....	Mr. Cassidy.	Alcoholic.
1201	..	12+	South Carolina.	.....	Wm. Stimpson.	"

OPHIONEREIS LÜTKEN.

TYPE OF THE GENUS, *O. reticulata* Lütken.

Disk covered with flat scales, varying little in size, overlapping, rounded. Teeth. Mouth-papillæ. No tooth-papillæ. Smooth spines (commonly three) along the sides of the side arm-plates. One large tentacle-scale. Each upper arm-plate furnished with a supplementary piece on either side. Two genital slits beginning outside the mouth-shields.

SPECIES HEREIN DESCRIBED.

O. reticulata.

O. annulata.

O. Xantusii.

O. porrecta.

O. dubia.

Ophionereis reticulata LÜTKEN.

Ophiura reticulata SAY. Journ. Phil. Acad., V. p. 148. 1825.

Ophiolepis nereis LÜTKEN. Vidensk. Meddelelser. March, 1856.

Ophionereis reticulata LÜTKEN. Addit. ad Hist. Oph., p. 110.

Special Marks.—Disk yellowish brown, with a network of five brown lines. Middle arm-spine about twice as long as the under arm-plate.

Description of a Specimen.—Diameter of disk, 11.5^{mm}; outer edge of mouth-shield to outer corner of opposite mouth-slit, 4.4^{mm}; greatest width of arm without spines, 2.2^{mm}; length of arm, 90^{mm}; distance from outer edge of mouth-shield to inner points of tooth-papillæ, to that between outer corners of mouth-slits, as 2 : 2.2. Ten mouth-papillæ to each angle of mouth; outermost one small and sharp; the rest short, flat, and stout; the two innermost ones point to centre of mouth, and are shortest and most rounded. Teeth five, flat, square, and thin, the lowest one smallest. Mouth-shields long heart-shaped, point inward, varying somewhat in size; length to breadth, 1.4 : 1.2; madreporic shield broader. Side mouth-shields very long triangular, varying somewhat, connecting first under arm-plate with mouth-shield; length to breadth, .8 : .4. Under arm-plates have general form of squares with rounded corners; first plate very small, narrowest at inner end; length to breadth, .4 : .4; second plate, inner side nearly straight, outer side curved, lateral sides nearly straight; length to breadth, .6 : .8; twelfth plate, outer side a little re-enteringly curved, inner side slightly curved, lateral sides a little re-enteringly curved, outer corners well rounded, inner corners slightly peaked; length to breadth, .8 : 1; this is the typical form; about two thirds out on arm, length to breadth, .8 : .8; at tip of arm, plates long heart-shaped, point inward, longer than broad. Side arm-plates small, being reduced to a ridge, bearing arm-spines; this is very low, so that bases of arm-spines stand almost directly on arm proper. Upper arm-plates have at base of arm the shape of a pointed, distorted oval; first three plates very small, like scales (somewhat as in *Ophiocoma crassispina*), each larger than its successor; fourth plate, inner side slightly curved, outer side short, lateral sides long and sloping; length of plate, .6; outer corners much rounded, so that outer side and lateral sides may be said to form one curve; this is the typical shape; twelfth plate larger; length to breadth, .8 : 1.6; about two thirds out on arm, outer side and laterals not forming one curve, but quite distinct; length to breadth, .6 : 1.2. Here the supplementary plates become much smaller, and finally disappear close to the tip of the arm; and, on the other hand, the true upper plates begin to

approach the hexagonal form ; the inner side and inner laterals become distinct from each other, as do the outer side and outer laterals. Close to tip, length to breadth, $.4 : .8$; at tip of arm, plates heart-shaped, the point inward. Supplementary upper plates fill the space between true upper arm-plates and upper arm-spine ; they are nearly triangular, with two angles directed sideways, and one inward ; side next upper arm-plate, nearly straight ; other two a little curved ; length of sides at tenth joint, outer side 1, other two $.8$. Disk : radial shields small and narrow, blunt at outer end, sharp at inner end, placed just opposite out-side line of each arm ; length about 1^{mm} . ; breadth, $.4^{mm}$. ; starting from each radial shield, and running along edge of disk, is a row of about seven scales, much larger than the rest, largest having a length of $.4^{mm}$. ; scales just round and between radial shields somewhat larger than those toward centre of disk, which are very minute, about 230 to a square *mm*. ; on under surface of disk, similar scales ; starting at mouth-shield, and running along edge of genital slit for about half its length, is a narrow ridge, bearing a single row of small papillæ. Arm-spines : second joint, two ; length to that of under arm-plate, $.6, .6 : .6$; third joint, three spines ; fourth joint, three spines, $.6, .8, .8 : .6$; seventh joint, three spines, $.8, 1.2, .8 : .6$; all other joints, to very near tip of arm, three spines ; twenty-second joint, $1.2, 1.6, 1.4 : .8$; about two thirds out on arm, $.8, 1, .8 : .8$; it is only at extreme tip of arm that there are only two spines. Tentacle-scales near base of arm having a length of $.4^{mm}$, in form short oval. Color, in alcohol : general tint of upper parts very light grayish-brown (vandyke-brown and a little neutral tint) ; upper surface of disk irregularly reticulated with lines of light brown ; upper surface of arms barred with greenish black ; bars usually the width of a joint, seldom more ; their dark color not uniform, but concentrated round edges of upper arm-plates ; general tint of under surface like that of upper, but lighter ; mouth-shields, tentacle-scales, larger arm-spines, and some of under arm-plates, faintly marked with light brown ; towards end of arm some faint bars on its under surface ; just outside mouth-shield, the interbrachial space is dark umber-brown.

Variations. — A young one, with a disk of 3^{mm} , differed from the adult principally as follows : the disk had the primary plates still large and distinct, although they were smaller, and the other scales more numerous than in the young *O. annulata* of the same size ; the under arm-plates were longer ; the mouth-shields were pointed at their inner end, and the side mouth-shields were so large as nearly, or quite, to meet within. The proportions of the disk to the arms range as follows : $5.1 : 23, 8 : 47, 10 : 60, 11.5 : 90$. The colors vary but little.

This species is distinguished from *O. annulata* by having the middle arm-spine shorter ; from *O. porrecta*, by longer arm-spines ; and from *O. Xantusii*, by sharper arm-spines and longer arms.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
12	..	12+	Cape Florida.	Apr. 1858.	G. Wurdeman.	Alcoholic.
13	..	2	Florida.	.....	Prof. Agassiz.	"
14	..	4	Tortugas, Fla.	Mh. 15, 17, '58.	J. E. Mills.	"
15	..	4	Key West, Fla.	Mar. 6, 1858.	J. E. Mills.	"
16	..	1	Tortugas, Fla.	Feb. 1856.	T. Lyman.	"
17	..	1	Tortugas, Fla.	Ap. 13, 1858.	J. E. Mills.	"
18	..	1	Key Biscayne, Fla.	Feb. 1856.	T. Lyman.	"
19	..	1	Near Cape Florida.	Feb. 1856.	T. Lyman.	"
20	..	12+	St. Thomas, W. I.	.....	A. H. Riise.	"
21	54 ^a	3	Bermudas.	.....	Univ. Mus. Cop'hagen.	"
22	56 ^a	4	West Indies.	.....	Univ. Mus. Cop'hagen.	"
23	..	12+	Cape Florida.	.....	G. Wurdeman.	"
24	..	2	Tortugas, Fla.	.....	Capt. D.P. Woodbury.	"
25	..	2	Bay of Cumana, South America.	.....	Capt. Couthouy.	"
<i>Smithsonian Institution.</i>						
1010	..	8	Cape Florida.	.....	G. Wurdeman.	Alcoholic.
993	..	1	Tortugas, Fla.	.....	Capt. Woodbury.	"
992	..	2	Florida.	.....	.....	"
1003	..	1	St. Thomas, W. I.	.....	University Museum, Copenhagen.	"
1194	..	1	Florida.	.....	Dr. Cooper.	"
1079	..	2	St. Thomas, W. I.	.....	A. H. Riise.	"
1114	..	3	St. Thomas, W. I.	.....	A. H. Riise.	"
1158	..	3	St. Thomas, W. I.	.....	A. H. Riise.	"

Ophionereis annulata LYMAN.

Ophiopsis annulata LeConte. Proceed. Phil. Acad., V. p. 317. 1851.

Ophiopsis triloba Lütken. Vidensk. Meddelelser. March, 1856.

Ophiopsis triloba Lütken. Addit. ad Hist. Oph., p. 112.

Ophionereis annulata Lyman. Proceed. Boston Soc. Nat. Hist., VII. p. 203.

Special Marks.—Disk ash-gray, white, or purplish brown, spotted with light; arms banded. The middle arm-spine about three times as long as the under arm-plate.

Description of a Specimen.—Diameter of disk, 11.5^{mm}.; from outer side of mouth-shield to outer corner of opposite mouth-slit, 5^{mm}.; width of arm without spines, 2.2^{mm}.; length of arms, 84^{mm}.; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 2:2.5. Mouth-papillæ nine or ten, small, rounded, blunt, except outer one, which is minute and sharp-

pointed; the one next to the outer is the largest of all. Teeth five, squarish, a little swelled at the cutting edge; lowest one much shorter than the rest, and somewhat thickened. Mouth-shields nearly rounded, with a slight peak outwards; length to breadth, 1.4:1.4. Side mouth-shields rather larger than usual in this genus; triangular, rounded without, pointed within. Under arm-plates squarish, outer side with a notch, inner side curved, lateral sides re-enteringly curved, outer corners cleanly rounded; length to breadth (twenty-second plate), .7:1.1. Upper arm-plates wider within than without; outer side either forming a single curve, or broken into three sides, an outer and two lateral; inner side broken into three parts, an inner and two inner laterals, all of them lying almost in the same line; length to breadth (twenty-ninth plate), .7:1.7. Supplementary pieces as long as the joints, triangular, with the outer side somewhat rounded. Disk-scales very fine above and below; coarser along edge of disk; where they are finest, about 170 to a square *mm*. Radial shields small, narrow, sharp at both ends; length, .8^{mm}. Arm-spines rounded, tapering, a little flattened, regular; middle one longest; lengths to that of under arm-plate (twenty-fourth joint), 1.2, 2.2, 1.6: .7. Tentacle-scale large, rounded oval; length to that of under arm-plate, .5: .7. Color, in alcohol: above, disk dull ash-gray (burnt umber and neutral tint), ground color of arms pale yellowish-gray, with broad bands of dark ash-gray; even the lighter rings have usually markings of darker; three joints of light usually alternate with three of dark; below, interbrachial spaces veined with fine brown lines; a patch of nearly black just outside the mouth-shields; rest of under surface nearly white, with a few under arm-plates brown.

Variations.—The commonest pattern of color seems to be a purplish-brown disk, with numerous light spots, and light-greenish arms, with rings of purplish brown; sometimes the disk is white. A young one, with a disk of 3^{mm}, had arms 15.5^{mm} in length. The upper surface of the disk was chiefly occupied by the large primary plates, of which there was a rosette of six in the centre, and these did not overlap each other; other primary plates were arranged about them, and between these were a few small, overlapping scales. The radial shields were separated by three scales, and were larger proportionately than in the adult. The upper arm-plates were nearly circular, the supplementary pieces comparatively small. Below, the parts were pretty much as in the adult, except that the under arm-plates were proportionately longer, and the side mouth-shields and interbrachial spaces larger.

This species has longer arms and sharper spines than *O. Xantusii*; and the middle arm-spine is longer than in *O. reticulata*, or in *O. porrecta*. The following table will show their proportions:—

	Disk.	Arms.	Lower Arm-plate.	Middle Arm-spine.
<i>O. reticulata</i> ,	10.5	70 . . . . .	.7	1.6
<i>O. Xantusii</i> ,	7.7	40 . . . . .	.5	1.2
<i>O. porrecta</i> ,	12.0	113	1.0	1.7
<i>O. annulata</i> ,	11.5	84 . . . . .	.7	2.2

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
28	..	8	Panama.	.....	Alex. Agassiz.	Alcoholic.
29	57	1	West Coast of Central America.	.....	University Museum, Copenhagen.	"
30	..	8	Panama.	.....	Dr. J. LeConte.	Dried.
<i>Smithsonian Institution.</i>						
1038	..	1	Panama.	.....	Rev. T. Powell.	Alcoholic.
1096	..	1	Panama.	.....	.....	"
1097	..	1	Panama.	.....	.....	"
1200	..	5	Panama.	.....	Dr. J. LeConte.	Dried.
1191	..	1	Cape St. Lucas, Cal.	.....	J. Xantus.	Alcoholic.

Ophionereis Xantusii LYMAN.

Ophionereis Xantusii LYMAN. Proceed. Boston Soc. Nat. Hist., VII. p. 258. 1860.

Special Marks. — Brownish straw-color, arms banded with dark purple. Arms about five times as long as the diameter of the disk.

Description of a Specimen. — Diameter of disk, 7.7^{mm.}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 3^{mm.}; width of arm without spines, 1.2^{mm.}; length of arm, 40^{mm.}; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 1.2 : 1.5. Mouth-papillæ, ten or eleven to each angle of mouth, small, rounded, somewhat flattened. Teeth four, thin, flat, squarish; lowest one thicker, and with a rounded cutting edge. Mouth-shields much rounded heart-shaped, with narrow end inward; length to breadth, 1 : .9. Side mouth-shields short triangular, widely separated within. Under arm-plates squarish, a little longer than broad; outer side slightly curved; lateral sides a little re-enteringly curved; inner laterals and inner side of about the same length, and lying nearly in the same line; length to breadth (seventeenth

plate), .5 : .4. Upper arm-plates triangular, with a rounded angle directed outward, and a sharp angle directed towards each side; length to breadth (eleventh plate), .5 : .9. Supplementary pieces as long as the joints, triangular, with outer side curved; near the end of the arm they become proportionately smaller, and the upper arm-plates gradually take on a more hexagonal shape. Disk-scales very close and fine, about 200 to a square *mm.* Radial shields very small and narrow, about .7^{mm.} long. The usual comb of papillæ along the edges of the genital slits is not much developed. Arm-spines rather short, flattened, and cut off square at the end; middle one longest; lengths to that of under arm-plate (seventeenth joint), .7, 1.2, .9 : .5. Tentacle-scale large, round, thin; length to that of under arm-plate, .3 : .5. Color, in alcohol: above, disk faint greenish-gray, finely lined with brownish; above the base of each arm a dark-purple fork, of two converging lines; sometimes a few other veins of dark purple; arms brownish straw-color, with a faint, broken line of whitish running lengthwise; at intervals of from five to twelve joints, a dark purple joint, making a cross band; below, interbrachial spaces same as upper surface; other parts light straw-color.

Variations.—The color seems pretty uniform; the dark markings at the base of the arms may differ somewhat in shape and size, and the arm bands may either go entirely round, or be confined to the upper surface. A small specimen, with a disk of 4.2^{mm.}, had arms of 22^{mm.}. The number of disk-scales to a square *mm.* was about the same as in larger ones. The lower arm-plates were longer, and more concave on their lateral sides; the teeth had all round cutting edges; the spines were more rounded and tapering than in the adult; length of the longest to that of under arm-plate, .5 : .3; the radial shields could hardly be distinguished. The mouth-shields vary a little in being more or less rounded.

O. Xantusii differs from *O. annulata* in having shorter and blunter arm-spines, and shorter arms; the color is also different;—from *O. reticulata*, in blunter arm-spines, shorter arms, and a different pattern of color.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
31	1164	1	Cape St. Lucas, Cal.	.....	J. Xantus.	Alcoholic.
<i>Smithsonian Institution.</i>						
1164	..	5	Cape St. Lucas, Cal.	.....	J. Xantus.	Alcoholic.

Ophionereis porrecta LYMAN. (Figs. 14, 15.)

Ophionereis porrecta LYMAN. Proceed. Boston Soc. Nat. Hist., VII. p. 260. 1860.

Special Marks. — Dull reddish-brown. Arms, in adult specimens, nine times as long as the diameter of the disk. Arm-spines short.

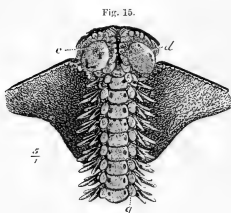
Description of a Specimen. — Diameter of disk, 12^{mm.}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 4.5^{mm.}; width of arm without spines, 2.5^{mm.}; length of arm, 113^{mm.}; distance from outer side of mouth-shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 2:2.2. Mouth-papillæ ten, short, stout, the outermost but one broadest. Teeth four or five, stout, squarish, rather long, a little tapering, lowest one shortest. Mouth-shields oval; length to breadth, 1.6:1. Side mouth-shields very small, triangular, sometimes almost obliterated. Under arm-plates squarish, broader without than within; outer side curved, inner side nearly straight, lateral sides re-enteringly curved; length to breadth (twentieth plate), 1:1.2; (fortieth plate), 1:1.4. The first plate is wedge-shaped, with a curved outer side. Upper arm-plates varying in proportionate breadth according to the width of the arm, usually broader than long; inner side much longer than outer one; outer and lateral sides sometimes distinguished, and sometimes confounded in a common curve; length to breadth (sixth plate), .8:1.5; (thirty-fifth plate), 1:1.6. Scales of disk rather stouter than usual in the genus; about 80 to a square *mm.* Radial shields 1.2^{mm.} long. Scales on edge of disk larger than the rest. Papillæ along edges of genital slits stout and prominent. Arm-spines short, rounded, tapering; lengths to that of under arm-plate (twenty-

Fig. 14.



Ophionereis porrecta.
(Upper side.)
p, arm-spines

third joint), 1, 1.7, 1.3 : 1. Tentacle-scale oval, large ; length to that of under arm-plate, .6 : 1. Color, in alcohol : above, disk minutely mottled and lined with reddish brown (vandyke brown and red chalk) and dirty white ; arms the same, but darker, with occasionally a light-colored joint ; arm-spines pale brown, with one or two darker rings ; underneath inter-brachial spaces tawny brown ; darker along the genital slits ; mouth-parts and under arm-plates white ; the arm-plates and mouth-shields with a few specks of various tints of brown.



Ophionereis porrecta. (Lower side.)
d, mouth-papillae ; *c*, inner point of mouth angle ;
g, tentacle-scale.

Variations. — A young one, with a disk 3^{mm}. in diameter, had arms 18^{mm}. long. The disk-scales were large, about 40 to a square *mm*., and among them could plainly be recognized the primary plates ; the radial shields were conspicuous, though small, and were separated by a wedge of two or three scales ; the upper arm-plates were very nearly circular, and overlapped each other ; the lower arm-plates were shield-shaped, with an angle within, and a wide, straight outer side, and were entirely separated by the encroachment of the side arm-plates. The other parts were as in the adult, except that the side mouth-shields were proportionately larger. In a specimen with a disk of 5^{mm}., the upper arm-plates were shaped nearly as in the adult ; the under arm-plates were tawny red. Among the young the radial shields were commonly bordered with dark brown, with a white centre. The other colors varied chiefly in intensity.

The locality of these specimens has unfortunately been lost ; but they are believed to be from the Atlantic coast of America, and are therefore included here. The species is distinguished from others by the great length of the arms, the shortness of the arm-spines, and the general robustness of the structure.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
11	..	7	Florida ?	.....	.....	Alcoholic.

Ophionereis dubia LYMAN.*Ophiolepis dubia* MÜLL. & TROSCII. Syst. Asteriden, p. 94.SAVIGNY. Descr. de l'Égypte (Audouin). 1809. Pl. 1, Figs. 3¹–3¹⁰.

The plate of Savigny is most excellent, and gives all the details of the genus and species. The specimen doubtless came from the Red Sea, as the species is not found in the Mediterranean.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
434	Red Sea.	.....	Jardin des Plantes.	Alcoholic.

OPHIOPSILA FORBES.

TYPE OF THE GENUS, *O. aranea*.

Disk covered with very minute, overlapping, smooth scales. Radial shields small, or else quite covered. Teeth. Tooth-papillæ. A few side mouth-papillæ. Arm-spines short, flattened, rather rough, numerous, arranged along sides of side arm-plates. Inside tentacle-scale very long, like a spatula. Lower arm-plates faintly indicated and sunken, making a groove in which lie the long tentacle-scales. Two genital slits beginning outside the mouth-shields.

SPECIES HEREIN DESCRIBED.

*O. Riisei.**O. aranea.*

Ophiopsila Riisei LÜTKEN. (Figs. 16, 17.)*Ophiopsila Riisei* LÜTKEN. Addit. ad Hist. Oph., p. 136. 1859.

Special Marks. — Arm-spines, six or seven. In the adult, many of the upper arm-plates split in two. Color, in alcohol: gray, with fine black specks.

Description of a Specimen. — Diameter of disk, 8.6^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 3^{mm}; width of arm without spines, 2^{mm}. For length of arm, see *Variations*. Distance from outer side of mouth-shields to inner points of tooth-papillæ,

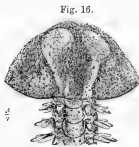


Fig. 16.
Ophiopsila Riisei. (Upper side.)

to that between outer corners of mouth-slits, 1.6 : 1.6. Mouth-papillæ, six to each corner of the mouth, of which the outer one is a minute tubercle, scarcely perceptible; the two inner ones on either side large, flat, and square. Tooth-papillæ in an irregular bunch, about nine in number; lowest ones smallest, and placed more outward. Teeth five, four upper ones broad, short, thick, even, squarish; lowest one narrower, and more like a large tooth-papilla. Mouth-shields broader than long, oval diamond-shaped, with a peak within; the outer side curved, and the lateral ends more or less truncated; length to breadth, .7 : 1. Side mouth-shields scarcely to be seen, even in dried specimens. They seem to run along the inner side of the mouth-shield, but are extremely narrow, and are often quite

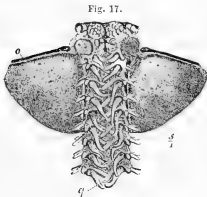


Fig. 17.
Ophiopsila Riisei. (Lower side.)
g, tentacle-scul; a, genital opening.

confounded with the surrounding parts. Under arm-plates broader than long, slightly separated, nearly rectangular, but a little wider without than within; length to breadth (fifteenth plate), .5 : .7. Upper arm-plates broader than long, nearly oval, somewhat angular, however, at the corners; many of them broken lengthwise in two pieces; the first six or eight plates are proportionately smaller, narrower, and more rounded than those just beyond; length to breadth (third plate), .5 : .7; (twenty-third plate), .6 : 1. Disk-scales covered with a thick skin, so that they are not easy to see, even in a dried specimen; about 150 to a square *mm*. where they are finest; over the places of the radial shields, somewhat coarser. Arm-spines usually six, near the disk seven; cut square off at

the end; lengths to that of under arm-plate (thirteenth joint), .5, .4, .4, .4, .5, 8:5. Outside tentacle-scale minute, flattened, spiniform; length of inside scale to that of under arm-plate, 1:5. Color, in alcohol: nearly uniform pale brownish-gray, with numerous specks of black pigment on the back and interbrachial spaces of the disk, and on the upper arm-plates; mouth-parts nearly white, with a black speck on each mouth-shield.

Variations.—The coloration in alcoholic specimens is nearly uniform, and the other characters vary little. A specimen with a disk of 8^{mm}, had arms 100^{mm}. long. This may be considered an average proportion. Almost always the tips of the arms are broken off. The largest specimens have a disk of over 11^{mm}.

O. Rüsei has been found at St. Thomas by Mr. Rüse, but is apparently not very common there; and the same remark is true of the Tortugas Islands, of Key West, and of some other parts of Florida; but at Cape Florida it has been taken in the greatest abundance.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
1	..	12+	Cape Florida.	Apr. 1858.	G. Wurdeman.	Alcoholic.
2	..	1	Florida?	.....	Prof. Agassiz.	"
3	..	2	Key West, Fla.	Jan. 1858.	J. E. Mills.	"
4	..	1	Florida.	.....	Prof. Agassiz.	"
5	..	2	Cape Florida.	.....	G. Wurdeman.	"
6	..	1	Florida.	.....	Prof. Agassiz.	"
<i>Smithsonian Institution.</i>						
995	..	12+	Cape Florida.	.....	G. Wurdeman.	Alcoholic.
1177	..	1	Florida.	.....	.....	"

Ophiopsila aranea FORBES.

Ophiopsila aranea FORBES. Trans. Linn. Soc., XIX. p. 149.

Ophianoplus marmoreus? SARS. Nyt. Mag. for Naturvid., X. p. 23.

Ophiopsila marmorea LÜTKEN. Addit. ad Hist. Oph., p. 136.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
424	Alger.	.....	Jardin des Plantes.	Alcoholic.

OPHIOCNEMIS MÜLL. & TROSCHEL.

Müller and Troschel made a most singular mistake in examining the original specimen of Lamarck's *Ophiura marmorata*, on which is founded this genus. The specimen having shrunk in drying, a small crack appeared between the arm-joints and the genital plate, and this was taken for a *second genital slit*, lying beside the usual one. I had an opportunity of closely examining this specimen in the Jardin des Plantes. Nevertheless the genus is a good one, on other grounds, and stands between *Amphiura* and *Ophiothrix*.

Ophiocnemis marmorata MÜLL. & TROSCHEL.

Ophiura marmorata LAMARCK. An. s. Vert., II. p. 543.

Ophiocnemis marmorata MÜLL. & TROSCHEL. Syst. Asterid., p. 87.

The original, in the Jardin des Plantes, is stated to come from the "Mers Australes," and was brought by Peron and Lesueur, in 1803.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
409	..	12+	Zanzibar.	.....	C. Cooke.	Alcoholic.
410	..	12+	Zanzibar.	.....	C. Cooke.	"
428, } young?	Trincomalee, Ceylon.	.....	{ Jardin des Plantes, Reynaud, 1829.	"

OPHIOTHRIX MÜLL. & TROSCH.

TYPE OF THE GENUS, *O. rosula* Forbes.

Disk with thorny grains, very short spines crowned with thorns, or spines with thorns at the sides and top. Radial shields large, triangular swellings, each bounded on its two inner sides by ridges in the skin of the back. Tooth-papillæ. Teeth. No mouth-papillæ. Spines numerous (often three times as long as the joints), flattened, glassy, thorny, having a central tube with slender side tubes from it. A small, spine-like tentacle-scale. No radial scales. The base of the jaw pierced with a hole, from a want of perfect union between the two pieces of the mouth-frames. Interbrachial spaces swelled out like lobes. Two genital slits beginning outside the mouth-shields. Outer arm-joints with hooks.

GROUPING OF SPECIES HEREIN DESCRIBED.

Disk closely beset with stout, longer and shorter spines,	<i>O. rosula.</i>
	{ <i>O. Örstedii.</i>
Disk with long, slender spines,	{ <i>O. Suensonii.</i>
	{ <i>O. magnifica.</i>
	{ <i>O. virgata.</i>
	{ <i>O. angulata.</i>
Disk usually beset with short, forked, and with long, slender spines,	{ <i>O. violacea.</i>
	{ <i>O. spiculata.</i>
	{ <i>O. dumosa.</i>
Disk with fine, thorny grains; upper arm-plates regularly hexagonal,	<i>O. lineata.</i>
Disk and radial shields closely beset with spiny cylinders; thorny grains on upper arm-plates,	{ <i>O. demessa.</i>
Disk scaled, and sparsely beset with thorny grains,	<i>O. propinqua.</i>
Disk beset with thorny stumps; radial shields closely covered with grains,	<i>O. Cheneyi.</i>
Disk and radial shields as in the last; upper arm-plates regularly angular; arms very long,	{ <i>O. longipeda.</i>

Ophiothrix rosula FORBES.

STELLA SCOLOPENDROIDES; *Rosula scolopendroides* LINCK. De Stel. Mar., p. 52, Pl. XXVI. Fig. 42. 1733.

Asterias fragilis O. F. MÜLLER. Zoöl. Dan., p. 28, Pl. XCVIII. 1789.

Ophiura fragilis et *O. tricolor* LAMK. Hist. Anim. s. Vert., II. p. 546. 1816.

Ophiocoma rosula FORBES. Brit. Starfishes, p. 60. 1841.

Ophiothrix rosula FORBES. Linn. Trans., XIX. p. 151. 1842.

Ophiothrix fragilis, *O. echinata*, *O. tricolor*, et *O. Féussacii* MÜLL. & TROSC. Syst. Asteriden, pp. 110–112. 1842.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
142	..	1	North Europe.	.....	Prof. Sars, 1852.	Alcoholic.
143	46	2	Oresund.	.....	University Museum, Copenhagen.	"
417	St. Va-est-la-Hongue, France.	.....	Jardin des Plantes.	"
392	Cette, France.	.....	T. Lyman.	"
418	Oran, Algeria.	.....	Jardin des Plantes.	"

Ophiothrix Örstedii LÜTKEN.

Ophiothrix Örstedii LÜTKEN. Vidensk. Meddelelser. Jan., 1856.

Ophiothrix Örstedii LÜTKEN. Addit. ad Hist. Oph., p. 149.

Special Marks.—Bluish or greenish, with cross lines of white on arms, above. Spines on disk slender and rather long.

Description of a Specimen.—Diameter of disk, 8^{mm.}; outer edge of mouth-shield to outer corner of opposite mouth-slit, 3.6^{mm.}; width of arm without spines, 2.7^{mm.}; length of arm about 58^{mm.}; distance from outer edge of mouth-shield to the points of the tooth-papillæ, to that between the corners of the mouth-slits as 1.6 : 1.6. Tooth-papillæ arranged in six horizontal rows, three in each row, except the lowest one, which has usually only two; they have the appearance of a bundle of small spines, soldered compactly side by side; the papillæ on the sides of each row project towards the centre of the mouth more than the middle one does. Teeth five, the highest small and somewhat pointed; lowest evidently made of soldered tooth-papillæ. The mouth-shields are closely soldered with the surrounding parts, so that it is

hard to distinguish their true outlines; they are nearly oval, with a slight peak towards the mouth; length to breadth as .6:1 or .8:1. Madreporic mouth-shield longer, larger, and more swelled than the others; length to breadth as 1:1. Side mouth-shields soldered closely with surrounding parts, slender and wedge-shaped, their broadest end being toward the arm; they run along the inner sides of the mouth-shield, and nearly meet at its inner points; length to breadth, .6:4, or .8:4; as the madreporic mouth-shield extends inwards, the side mouth-shields are here reduced to small triangular pieces on each side. General form of under arm-plates square, but broader than long; the first, second, third, and fourth somewhat compressed sideways, and varying a little in their proportions; the rest of the plates, even near the tip of the arm, nearly uniform in shape, each separated a little from its neighbors, the outer side a slightly re-entering curve, the lateral sides curved a little, the inner side not well defined, but nearly straight; length to breadth (ninth), .7:1; about two thirds the length of arm, .6:6. Upper arm-plates covered, like those on the sides, with skin; their outlines can only be seen in dried specimens; there are four sides, of which the outer is curved, the two lateral straight, and the inner straight, but so short that the plate looks like a short wedge, with the point towards the disk; the first three or four plates vary in size, but are all small, the innermost often so small that the side arm-plates nearly or quite meet above; the plates beyond larger; length to breadth as follows: second plate, .6:.8, or .4:.6; seventh, .8:.8; inner side of seventh plate, 4^{mm} ; the outer edge of each is slightly higher than the next plate, but does not overlap it. Disk, above, the large radial shields are nearly or quite naked; the rest of the back takes the form of a ten-rayed star, with a small centre; the brachial rays are narrow, and separate each radial shield from its mate; the interbrachial rays are wider, and separate the pairs of radial shields; both are beset with spines; the measures are as follows: diameter of centre of star, 2.4^{mm} ; length of brachial ray, 3^{mm} ; breadth of same, $.4^{\text{mm}}$; breadth of interbrachial ray close to centre, 1^{mm} , or 1.2^{mm} ; width of radial shield at outer edge, 1.4^{mm} to 1.8^{mm} ; length of the same, 2^{mm} to 2.2^{mm} ; the brachial rays are of even width till near the base of the arm, where they contract; each bears a single row of about five long, tapering spines; the interbrachial rays are of even width till near the edge of the disk, where they grow wider, and pass over the edge to the under surface of the disk; the spines long and tapering, irregularly placed in three longitudinal rows, each of seven or eight; radial shields quite smooth, sometimes with a single spine. The spines of the brachial rays have a length of 1.2^{mm} to 1.6^{mm} ; those of the interbrachial rays, 1^{mm} to 1.2^{mm} . The second joint bears only two small, nearly equal, slender spines, having a length to that of the under arm-plate as .8:.8. Third

joint, four small, slender spines, whose length to that of the lower arm-plate is as .8 : .8 ; fourth joint, five spines, 1, 1, 1, 1, .8 : .8 ; fifth joint, five spines, the upper ones much the longest ; sixth joint, nine spines, four upper ones, 2.8, 2.6, 2.2, 1 : .8. Arm-spines of the seventh joint have a length, compared with that of the under arm-plate, as follows : (beginning above), 2.8, 2.8, 2.8, 2.8, 2.2, 1.6, 1, .8, .6 : .8 ; there may also be a short supplementary spine on one side above the upper long one. Seventh joint may also have only eight spines ; eighth, eight spines, four long, four short ; ninth, seven spines, two long, two middling, three short ; tenth, eight spines, viz., 2, 2.8, 2.8, 1.6, 1.2, .8, .6, .4 : .8 ; eleventh, seven spines, three long, four short ; fifteenth joint, 2.4, 3.8, 3.8, 1.6, 1.2, .8, .5 : .8. In the neighborhood of the twenty-fifth joint, the spines are only six, and have a length to that of the lower arm-plate as follows : 3.6, 3.6, 1.2, 1, .6, .4 : .8. The longer spines, near the base of the arm, have on either edge from four to nine sharp thorns. The spines on the disk are rather less flattened and more slender, and have one or two thorns on each edge. The spinous rays of the back of the disk in an alcoholic specimen are dark cobalt blue, with a greenish hue ; radial shields the same, but lighter ; tooth-papillæ white ; mouth-shields, side mouth-shields, under arm-plates, and side arm-plates, very light cobalt blue, with a greenish tinge, irregularly edged and speckled with white. Upper arm-plates bluish green mottled with white ; between the joints a triple line, consisting of a dark line, with an irregular white one on each side. Arm-spines transparent greenish-blue, with purplish ends. Interbrachial spaces underneath similar to upper surface.

Variations. — The color in alcohol is about the same as that of the living animal ; it is either bluish or greenish. The young show the oblong scales of the disk very distinctly.

The white cross lines on the arms easily distinguish this species from *O. magnifica*, which, moreover, is larger, and has much stouter spines. It is the most abundant species of Florida and the West Indies.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
116	..	5	Tortugas, Fla.	Feb. 1856.	T. Lyman.	Alcoholic.
117	..	7	Key Biscayne, Cape Florida.	Feb. 1856.	T. Lyman.	"
118	..	12+	Florida.	.....	Prof. Agassiz.	"
119	..	12+	Cape Florida.	.....	G. Wurdeman and J. E. Mills.	"
120	..	12+	Key West, Fla.	Feb. 1856.	T. Lyman.	"
121	..	9	Key West, Fla.	Jan. 28, 1858.	J. E. Mills.	"
122	..	5	Tortugas, Fla.	Mh. 10, 1858.	J. E. Mills.	"
123	..	12+	Tortugas, Fla.	Feb. 1856.	T. Lyman.	"
124	..	12+	Key West, Fla.	Mh. 6, 1858.	J. E. Mills.	"
125	..	12+	Tortugas, Fla.	Apr. 24, '58.	J. E. Mills.	"
126	..	12+	Florida.	.....	G. Wurdeman.	"
127	..	12+	St. Thomas, W. I.	.....	A. H. Riise.	"
128	..	3	Bay of Cumana.	.....	Capt. Couthouy.	"
129	..	12+	Cape Florida.	Apr. 1858.	G. Wurdeman and J. E. Mills.	"
130	65 ^{ab}	6	West Indies.	.....	University Museum, Copenhagen.	"
131	..	1	Florida.	.....	Prof. Agassiz.	Dried.
<i>Smithsonian Institution.</i>						
1014	..	12+	Tortugas, Fla.	.....	Capt. Woodbury and Dr. Whitehurst.	Alcoholic.
1005	..	12+	Garden Key, Tortugas.	.....	.....	"
1006	..	12+	Cape Florida.	May, 1858.	G. Wurdeman.	"
1012	..	12+	Florida.	.....	.....	"
1160	..	7	St. Thomas, W. I.	.....	A. H. Riise.	"
1090	..	1	St. Thomas, W. I.	.....	A. H. Riise.	Dried.

Ophiothrix Suensonii LÜTKEN.

Ophiothrix Suensonii LÜTKEN. Vidensk. Meddelelser. Jan., 1856.

Ophiothrix Suensonii LÜTKEN. Addit. ad Hist. Oph., p. 148.

Special Marks.—Arm-plates as long as broad. Only about five arm-spines; upper one very long and slender. Color reddish, with a stripe of dark purple along arms.

Description of a Specimen.—Diameter of disk, 7.5^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 3.5^{mm}; width of arm without spines, 1.5^{mm}; length of arm, 68^{mm}; distance from outer side of mouth-shield to inner points of tooth-papillæ, to that between outer corners of mouth-slits, 1.7 : 1.7. Tooth-papillæ, eighteen, arranged in an oval figure, those outside longest, those in middle shorter; each outside row has six. Teeth four, upper one long-

est; rather thick, with rounded cutting edge. Mouth-shields very wide, short heart-shaped, with outer side straight, and a little peak within; length to breadth, .5:1. Side mouth-shields short triangular, with corners rounded, meeting within. Under arm-plates as long as broad, outer side longer than inner, corners rounded, a re-entering curve on lateral sides, where tentacle-scale comes; length to breadth (eighth plate), .7:.7. Side arm-plates strongly developed, and bearing stout projections to carry the arm-spines. Upper arm-plates about as long as broad; outer side strongly curved; inner side straight, and much shorter than outer; laterals straight and sloping; length to breadth (seventh plate), .7:.7. Disk with naked radial shields; brachial rays very narrow; on them and on the interbrachial rays and centre are scattered spines, long, thin, flattened, usually ending in a rather sharp point, about 2.2^{mm} in length, with about eight thorns on each edge. Radial shields presenting without an acute angle, terminating in a rounded peak; length to breadth, 2.5:1.4. Interbrachial spaces below with a few spines of same character as those above, but much shorter. Arm-spines five, sometimes six, upper one commonly much the longest; slender, sharp, somewhat flattened, with about nine thorns on each edge; ninth joint, five spines; lengths to that of under arm-plate, 4.5, 3.5, 2.8, 1.3, .2:.7; the minute lowest spine becomes a hook very near base of arm. The spines near the end of the arm are extremely long and slender. Tentacle-scales flat, rounded at point, of about same size as lowest arm-spine. Color, in alcohol: above, disk pale purplish, with outer ends of radial shields yellowish; along outer side of radial shields a narrow, raised edge of white; a broad band of very dark purple running along each arm, continued along brachial rays, and ending at centre of disk; side arm-plates mixed yellowish and purple; below, interbrachial spaces purplish, with fine cross lines of white; a broad band of light purple, bordered on either side by light, running whole length of arm; arm-spines white.

Variations. — In a specimen with a disk of 4^{mm} , the spines on the disk were fewer, and were mostly confined to the centre; those on the interbrachial spaces below were merely minute points; the lower arm-plates were longer, and their corners less rounded. In better preserved specimens the ground color was a dull lake-red (yellow ochre and red).

This species is very distinct from others of America in having the arm-plates as long as broad, and only four or five very long, slender arm-spines.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
144	..	3	St. Thomas, W. I.	.....	A. H. Riise.	Alcoholic.
145	64	2	West Indies.	.....	University Museum, Copenhagen.	"
146	991	1	Carthagena, New Grenada.	.....	A. Schott.	"
<i>Smithsonian Institution.</i>						
991	..	4	Carthagena, New Grenada.	.....	A. Schott.	Alcoholic.
1112	..	2	St. Thomas, W. I.	.....	A. H. Riise.	"

Ophiothrix magnifica LYMAN.

Ophiothrix magnifica LYMAN. Proceed. Boston Soc. Nat. Hist., VII. p. 254. 1860.

Special Marks. — A large species; back of disk closely spined; arm-spines stout, round, somewhat tapering; color bluish.

Description of a Specimen. — Diameter of disk, 12.5^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 5.6^{mm}; width of arm without spines, 2.7^{mm}; length of arm, 70^{mm}; distance from outer side of mouth-shield to inner points of tooth-papillæ, to that between outer corners of mouth-slits, 2.4 : 2.4. Tooth-papillæ about thirty-six, arranged in two rows of about ten each, which diverge from above downward, and are filled in between by smaller papillæ; the papillæ grow shorter and smaller from above downward. Teeth six, squarish, moderately stout, with rounded cutting edge; uppermost one thin, and so tapering as almost to be sharp. Mouth-shields small, almost circular; length to breadth, 1 : 1.2. Side mouth-shields meeting within. Under arm-plates covered with thick skin, and closely joined, so that their outline is indistinct; in form irregular oval; outer side longer than inner, and slightly re-entering; lateral sides well rounded; length to breadth, .7 : 1.3. Upper arm-plates small, with a strong median ridge; diamond-shaped, with outer angle much rounded, lateral angles sharp, and inner angle very slightly truncated; length to breadth (thirteenth plate), .7 : 1.2. Brachial and interbrachial rays of disk closely beset with round, stout, tapering spines, of very even length; they are covered with minute thorns, and terminate in a rather blunt crown of them; these spines have usually a length of about 1.3^{mm}. Radial

shields much obscured by surrounding spines, but bearing only a few small spines themselves; length to breadth, 3.5:1.7. Arm-spines stout, rather blunt, rounded, slightly and regularly tapering, deeply corrugated lengthwise, bearing many small, blunt thorns; upper spines scarcely flattened at all; second and third spines usually longest and stoutest; eleventh joint, eight spines; lengths to that of under arm-plate, 2.4, 2.6, 3.1, 2.1, 2.1, 1.5, .9, .5:7. Tentacle-scales distinct, flat, rounded at their outer end. Color, in alcohol: above, disk dull indigo-blue (cobalt and indigo-blue); arms the same, but banded with lighter; usually two or three joints to each band; arm-spines faint blue; below, interbrachial spaces a little lighter than upper surface; under arm-plates variegated with cross lines and specks of white, and of darker and lighter blue, giving the arm a banded appearance.

Variations. — The general color may incline more to greenish-blue, or, on the other hand, to purplish-blue; and the marking of the under arm-plates may form more or less distinct bands. The largest specimen had the disk 14^{mm} in diameter, and some of the spines on the disk as long as 2.1^{mm}. Many of the arm-spines were tipped with white.

This very beautiful *Ophiotrix* belongs to the group which has only long spines on the back of the disk; it differs from *O. Örstedii* in greater stoutness and shortness of the disk-spines, and in more cylindrical arm-spines; it has more and shorter spines than *O. Suensonii*, and is larger than either of these species.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
150	1043	1	Peru.	.....	Mr. Raymond.	Alcoholic.
<i>Smithsonian Institution.</i>						
1043	..		Peru.	.....	Mr. Raymond.	Alcoholic.

Ophiothrix virgata LYMAN.*Ophiothrix virgata* LYMAN. Proceed. Boston Soc. Nat. Hist., VIII. p. 82. 1861.

Special Marks. — Disk beset with slender spines. Arms twelve times as long as the diameter of the disk; along their upper side, a clear white line, bordered by a narrow blue one on each side.

Description of a Specimen. — Diameter of disk, 6^{mm}; width of arm without spines, 1^{mm}; length of arm, 75^{mm}. Tooth-papillæ thirteen, in horizontal rows of two or three; lowest ones the smallest. Teeth four, very thick and stout, standing close together. Mouth-shields heart-shaped, with a pretty distinct point inward, broader than long; length to breadth, .8:1. Side mouth-shields meeting nearly, or quite, within. Under arm-plates four-sided, with cleanly rounded corners; length to breadth (twelfth plate), .6:.7. Upper arm-plates wider without than within, outer side cleanly curved, lateral sides a little re-enteringly curved, and sloping towards the centre of the arm; length to breadth (eighth plate), .7:1. Disk above and below pretty closely covered with short, tapering, thorny spines, the longest 1^{mm}. in length, which nearly obscure the scaling of the disk, which may be distinguished through the skin. Radial shields nearly naked, separated by a single line of spiny scales; length to breadth, 1.8:1.2. Arm-spines six, slender, not swelled at the point, upper one commonly longest; lengths to that of under arm-plate, 1.7, 1.7, 1.4, .9, .6, .5:.6. Tentacle-scales very distinct, round. Color, in alcohol: above, pale blue on the disk, the radial shields with a speck of white at their outer ends; arms obscurely banded with paler and darker blue; along the middle of the arm, a clear line of white, bounded by a narrow blue line on each side; below, interbrachial spaces pale blue, the rest nearly white.

Ophiothrix spongicola must be quite near this species, but its arms are much shorter, and the pattern of color different.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
337	..	1	Kingsmills Islands.	.....	A. Garrett.	Alcoholic.

Ophiotrix angulata AYRES. (Pl. II. Figs. 1-3.)

Ophiura angulata SAY. Journ. Phil. Acad., V. p. 145. 1825.

Ophiotrix angulata AYRES. Proceed. Boston Soc. Nat. Hist., IV. p. 249.

Ophiotrix hispida AYRES. Proceed. Boston Soc. Nat. Hist., IV. p. 249.

Special Marks.—Pale bluish, with a white line along arms, and bands across them. Disk about 6.5^{mm} . Arm-spines numerous; often ten or eleven near base of arm. About eighteen tooth-papillæ.

Description of a Specimen.—Diameter of disk, 6.4^{mm} ; outer side of mouth-shield to outer corner of opposite mouth-slit, 2.8^{mm} ; width of arm without spines, 1.5^{mm} ; length of arm, 38.4^{mm} ; distance from outer side of mouth-shield to inner point of tooth-papillæ, to that between outer corners of mouth-slits as 1.6 : 1.4. Tooth-papillæ like a bunch of short, stout, blunt spines, soldered by their sides; arranged in five horizontal rows, of which the three highest have each four spines, the lowest one or two, and the other three; papillæ often irregularly placed, not in rows; the papillæ on the sides of the rows project more towards centre than do the middle ones. Teeth four, highest smallest, all thickened so as to touch, or nearly touch, each other. Mouth-shields closely soldered with side mouth-shields and with surrounding parts; in shape nearly oval, with a slight peak towards mouth; length to breadth, .6 : 1; madreporic shield larger. Side mouth-shields closely soldered with surrounding parts, in shape elongated triangular. Under arm-plates somewhat square; outer side a little re-enteringly curved; laterals rather strongly curved; inner side nearly straight; plates pretty closely soldered with each other and with surrounding parts; innermost plate small, nearly heart-shaped, with its joint inward; second plate contracted at its inner end; general form of other plates square, till near tip of arm, where they gradually get more elongated, their lateral sides straighter, and their outer sides more strongly re-entering; length to breadth (seventh plate), .5 : .6; about two thirds the length of the arm, .4 : .2; close to tip of arm, same proportion, but plates smaller, the breadths as above given; show also the lengths of the outer sides; the breadth of the inner side of the seventh plate is $.4^{\text{mm}}$. Side arm-plates covered with skin, so that their outlines are obscured, ridge bearing arm-spines, high, narrow, and of even width. Upper arm-plates pretty clearly marked, at base of arm; each has four sides, an outer, much curved, an inner, very short, and two lateral, nearly straight; inner side very short, so that plates seem like wedges, with their points turned inward; first two or three plates shorter than those that follow; plates near point of arm much elongated; length to breadth as follows: first plate, .6 : .6; sixth plate, .6 : .8; about two thirds the length of the arm,

.6 : .4 ; close to tip of arm, plates longer in proportion. Along the middle of each plate runs a ridge, and there is therefore a continuous ridge from the base to the point of the arm. Disk, above, with a raised star of ten rays and a small centre ; interbrachial rays high and broad, with a width of 1.2^{mm}. near centre of disk, and of 1.6^{mm}. at its edge ; closely beset with very small, short spines, ending in a triple fork ; about 34 spines to a square *mm*. ; interbrachial rays, meeting in middle of disk, make a centre to the star, having a diameter of 2^{mm}. ; brachial rays very low and narrow, and tapering to a point before reaching edge of disk ; greatest width, .2^{mm}. ; each bears a single row of forked spines. Radial shields, length 1.6^{mm}, greatest width 1^{mm}. ; each has about twelve scattered, forked spines. Besides short, forked spines, there are on the back of the disk a few longer, thorny spines, having a length of .8^{mm}, or 1^{mm}. Interbrachial spaces below have a triangular patch of close-set spines, which is a continuation of the interbrachial ray from above, this patch is bounded by a stripe of bare skin, .8^{mm}, which runs along the edge of the genital slits to the mouth-shields. Arm-spines, number of spines and lengths compared with those of the under arm-plates : second joint, two spines, .4, .4 : .6 ; third joint, four spines, .4, .4, .6, .6 : .6 ; fourth joint, six spines, .4, .6, .6, .8, .8, .8 : .6 ; fifth joint, eleven spines, 1.6, 1.6, 1.6, 1.2, 1.2, .8, .8, .8, .6, .4, .2 : .6 ; sixth joint, ten spines, longest one 2^{mm} ; seventeenth joint, six spines, 1.4, 2.8, 1.4, .6, .4, .2 : .6 ; three fourths out on arm, five spines, 1.4, 2, .8, .4, .4 : .4 ; the lowest spine has here the form of a heavy knife, bearing two or three hooks on its edge ; these hooks continue inwards to about the fiftieth joint from the tip, where they gradually take on the form of true spines ; at the tip of arm, four spines, the lowest a hook. The longer and stouter spines, near base of arm, have usually a thorny, rather blunt end, and twelve or fifteen thorns on each edge. Tentacle-scales, from base of arm quite to the tip there is a small, stunted spine, with two or three thorns at its end, which answers to the tentacle-scale. Color, in alcohol : general tint, a faded, grayish cobalt blue ; under arm-plates and mouth apparatus yellowish-white ; arms banded with darker blue ; interbrachial spaces on back of disk darker than brachial spaces ; a light line running along upper side of arm.

Variations.—The differences in color of this species, when living, are very great. According to colored drawings of about twenty varieties, belonging to Professor Agassiz, the disk may be various shades of vermilion, pink, purple, blue, dull green, brown, and yellow ; the radial shields seem always to differ from the rest of the disk ; the ground color of the arms, also, is usually different from that of the disk, and varies quite as much ; the arms are always banded. In alcohol the color has always a faded look, the specimens being either whitish, or

else dull green or blue. The young, with a disk of 3^{mm}., have arms 16^{mm}. in length; the disk is already closely covered with small spines, each bearing a crown of three long, sharp thorns; the arm-plates are proportionately longer than in the adult, and the arm-spines have rather longer thorns. Very often the adult has only spines of the smaller sort on the disk. Some specimens have the disk as large as 7^{mm}.

O. angulata bears some resemblance to *O. violacea*; the latter, however, has not banded arms, and has no such variety of coloration when living; moreover, *O. angulata* is smaller, has under arm-plates proportionately longer, arm-spines commonly more numerous, and about eighteen tooth-papillæ, while *O. violacea* has as many as thirty. It differs from *O. spiculata* and *O. dumosa* in fewer tooth-papillæ, shorter arm-spines, and in being a smaller species.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
132	..	12+	Charleston, S. C.	1851.	Prof. Agassiz.	Alcoholic.
133	..	12+	Charleston, S. C. ?	.....	.....	"
134	..	12+	Charleston, S. C.	1852.	Prof. Agassiz.	"
135	..	1	Waccamaw, S. C.	1853.	Prof. Agassiz.	"
390	North Carolina.	.....	.....	"
<i>Smithsonian Institution.</i>						
982	..	12+	South Carolina.	.....	Mr. Kurtz.	Alcoholic.

Ophiothrix violacea MÜLL. & TROSCH.

- Stella marina minor echinata purpurea*? SLOANE. Voy. to Jamaica, p. 272, pl. 244, f. 8, 9. 1725.
STELLA SCOLOPENDROIDES; *Jamaicensis purpurea*? LINCK. De Stel. Mar., p. 51. 1733.
Ophiothrix violacea MÜLL. & TROSCH. Syst. Asterid., p. 115. 1842.
Ophiothrix caribæa LÜTKEN. Vidensk. Meddelelser. Jan., 1856.
Ophiothrix Krøyeri LÜTKEN. Vidensk. Meddelelser. Jan., 1856.
Ophiothrix violacea LÜTKEN. Addit. ad Hist. Oph., p. 150. 1859.

Special Marks.—Dark-purplish blue, with a white line along the arm. Small, forked spines on the disk, with a few long ones.

Description of a Specimen.—Diameter of disk, 10^{mm}.; from outer side of mouth-shield to outer corner of opposite mouth-slit, 4^{mm}.; width of arm without spines, 2.3^{mm}.; length of arm, 62^{mm}.; distance from outer side of mouth-shield to inner points of tooth-papillæ, to that between outer corners of mouth-slits, 2 : 1.7. Tooth-papillæ arranged in an oval

figure, about thirty in number; those on sides larger and longer than central ones; lowest ones smaller, and more rounded and spine-like; upper ones larger and more flattened. Teeth three, thin, delicate, flattened, squarish. Mouth-shields diamond oval, with an angle inward and a curve without; length to breadth, 7:1.2; madreporic shield larger than others, and rounded. The two plates that join the outer side of the mouth-shield, making thus a bridge between the inner ends of the genital slits, are quite conspicuous. Side mouth-shields triangular, elongated, nearly meeting within mouth-shield proper; they are closely soldered with surrounding parts, and are hard to see except in a dry specimen. Under arm-plates broader than long, with a strongly re-entering curve on outer side; inner side nearly straight; lateral sides curved, or slightly angular; plates near base of arm have their outer side raised a little above succeeding plate; plates within margin of disk narrower, and more closely soldered to each other than those beyond; length to breadth (fourteenth plate), .7:1; about two thirds out on arm, plates nearly square, a little longer, however, than broad, with a re-entering curve in outer side, though less strong than in the plates near base of arm. Side arm-plates encroaching so much above as nearly to meet each other, even near base of arm. Upper arm-plates short diamond-shaped, with a slight median ridge; outer and inner angles more or less rounded; length to breadth (seventh plate), .7:1.2; about two thirds out on arm, plates have same general form, but are about as long as broad. Disk, above, closely beset with short spines without lateral thorns, each, however, crowned with three or four thorns; less numerous on radial shields; about 36 to a square *mm.*, where they stand thickest. Towards centre of disk a few longer spines, like those of arms, but more slender and shorter. Below, interbrachial spaces covered with spines somewhat longer than the short ones above. Radial shields beset with scattered spines; length to breadth, 2.4:1; their interbrachial side is strongly curved; their brachial side nearly straight, or a little re-enteringly curved; where they meet, just at their outer end, they have a slight protuberance; for the rest of their length they are separated by a tapering brachial stripe. Arm-spines about eight, long and slender; largest ones with fifteen to twenty thorns on each edge; lengths to that of under arm-plate as follows: (seventh joint,) 2.5, 3, 2.7, 2.3, 1.6, 1.6, .5:7. Sometimes there are as many as eleven spines, but the additional ones are very short, and are the lowest. About half-way out on arm six spines, lowest one broad and flat, with hooks on its edge; four upper ones long. Tentacle-scale minute, sharp, conical, usually simple, sometimes with a crown of two or three microscopic thorns. Color, in alcohol: above, bluish purple; along median line of arm, a narrow stripe of clear white, bounded each side by a dark stripe; two fine white spots on lateral corners; arm-spines

with a purplish tint; below, chewing apparatus yellowish, mouth-shields white, speckled with purplish blue; under arm-plates the same, but, in addition, bordered with pale purplish-blue; interbrachial spaces finely mottled with white and purplish blue.

Variations.—The color differs chiefly in being darker or paler; in the former case, the white spots on the upper arm-plates may be obliterated, and even the longitudinal white line become quite faint. Often the under arm-plates are white through the centre, while the lateral sides are dark blue. The proportions of disk to arms present such differences as the following: 9:53, 10:44, 7.5:42, 5:23. Dr. Lütken gives a measurement as high as 10:80. The average of seven measurements of the length of under arm-plates compared to that of longest arm-spines, near base of arm, was .7:3.1; the extremes were .6:3 and .8:3.2. The spines on the upper surface of the disk vary somewhat in number and also in the length of their thorns; those below vary very much in number, being sometimes closely set, sometimes almost wanting, sometimes thorny, sometimes smooth. The side mouth-shields sometimes quite meet within.

This species is apparently much more common at St. Thomas and the neighboring islands than in Florida. Certainly in Key West it is comparatively very rare. It is distinguished from other species as follows: from *O. Örstedii*, by short, forked spines of disk, and different pattern of color in alcohol; from *O. Suensonii*, by short, forked spines of disk, and a white median line along arm, instead of a dark one; from *O. lineata*, by more slender and numerous arm-spines, and by short, forked spines of disk; from *O. angulata*, by greater size (7^{mm}. diameter of disk, corresponds in *O. angulata* to about 10^{mm}. in *O. violacea*), by fewer long spines on disk, and by a much darker pattern of color, when in alcohol.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained..	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
137	..	4	Jeremie, Hayti.	.....	Dr. D. F. Weinland.	Alcoholic.
138	..	7	St. Thomas, W. I.	.....	A. H. Riise.	"
139	66 ^a	2	Rio Janeiro.	.....	Univ.Mus.Cop'hagen.	"
140	66 ^b	4	West Indies.	.....	Univ.Mus.Cop'hagen.	"
(?) 141	..	12+	Charlotte's Harbor, Fla.	.....	G. Wurdeman.	"
<i>Smithsonian Institution.</i>						
1017	..	1	West Indies.	.....	Univ.Mus.Cop'hagen.	Alcoholic.
1016	..	1	Rio Janeiro.	.....	Univ.Mus.Cop'hagen.	"
1159	..	3	St. Thomas, W. I.	.....	A. H. Riise.	"
1088	..	2	St. Thomas, W. I.	.....	A. H. Riise.	Dried.
1111	..	4	St. Thomas, W. I.	.....	A. H. Riise.	Alcoholic.

Ophiothrix spiculata LeConte.

Ophiothrix spiculata J. L. LeConte. Proceed. Phil. Acad., V. p. 318. 1851.

Ophiothrix spiculata Lütken. Addit. ad Hist. Oph., p. 151. 1859.

Special Marks.—Pale cobalt-blue in alcohol; longest arm-spines to under arm-plates as 3.1 : .6. Disk sometimes as large as 11.5^{mm}; specimens variable.

Description of a Specimen.—Diameter of disk, 9^{mm}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 4^{mm}; width of arm without spines, 2^{mm}; length of arm, 51^{mm}; distance from outer side of mouth-shield to inner points of tooth-papillæ, to that between outer corners of mouth-slits, 2 : 2. Tooth-papillæ, lowermost ones rounded, small, stout, making a cluster of about twelve; between this cluster and the teeth there are six very large, stout papillæ arranged in pairs. Teeth five, flattened, squarish, with rounded edge unusually stout and thick; uppermost one smaller and more tapering. Mouth-shields broader than long, with a slight peak inward; without, rounded; length to breadth, .8 : 1.4. Side mouth-shields meeting within. Under arm-plates broader than long, inner side shorter than outer, outer side a little re-enteringly curved, inner side nearly straight, lateral sides irregularly curved, outer corners strongly rounded; length to breadth (eleventh plate), .6 : 1; first four or five plates smaller and more square. Upper arm-plates with a median ridge, diamond-shape, with lateral corners acute, outer corners rounded, and inner corner truncated; length to breadth (third plate), .6 : 1. Brachial and interbrachial rays of disk closely beset with small and large spines, the small being usually about .4^{mm} long, surmounted by a crown of from three to six thorns, and sometimes with one or two thorns on their sides; the large ones are sometimes as long as 1.7^{mm}, similar in shape to arm-spines, but more slender, and bearing from five to eight fine thorns on each edge, and three or four at the tip. In interbrachial spaces below, only a few short, scattered spines; none at all close to mouth-shields. Radial shields large; length to breadth, 2.5 : 2; though obscured by the surrounding spines, they are themselves nearly naked, bearing only a few short spines, which are chiefly on the inner angle; they touch each other with their outer end, which is a little swelled, and has a short, narrow, raised edge. Arm-spines near base of arm, usually seven, rather slender, slightly tapering; longest ones with from fourteen to twenty-four fine thorns on each edge, and a cluster of still finer ones at the end; upper spine most tapering; second one longest, and cut off pretty square at the end, as are also the third and fourth spines; second spine often has a

length as great as 3.5^{mm} , and sometimes even 3.8^{mm} ; eighth joint, seven spines; lengths to that of under arm-plate, 3, 3.2, 2.3, 1.5, 1.6, .4 : .6. Tentacle-scale, instead of being spiniform, is flat and square, ending in four or five microscopic points. Color, in alcohol: above, faded cobalt-blue, with a brownish tinge towards centre of disk; along centre of arm a faint line of lighter; below, interbrachial spaces pale cobalt-blue; other parts the same, but lighter. In the living animal "the body is dark fuscous above, and pale beneath; every fifth ventral plate on the arms is sometimes red or brown," and the apex of the arm-spines is frequently black (LeConte); or the main color may be greenish, the upper arm-plates violet, and every fourth joint red (Dr. Örsted).

Variations. — Either this species is very variable, or else there are two or more species at present confounded under it. The specimen above described may be considered as the type; from which, however, there are considerable deviations, both in the armature of the disk and the length of the arm-spines. A specimen with a disk of 8^{mm} had the disk closely covered with short spines, bearing each a crown of from three to six thorns; there were no long spines on the disk; the seventh arm-joint bore eight spines, whose proportions to that of the lower arm-plate were as follows: 1.8, 2.2, 1.8, 1.2, .7, .6, .5, 4 : 6. The second spine was remarkably flat, and was cut square off at the end; it had thirteen thorns on each side. Another specimen, with a diameter of disk of 11.5^{mm} , had from seven to nine spines on the basal joints; the length of the three upper ones to that of the lower arm-plates being about 4.7, 4.5, 4.1 : .7. This specimen had the radial shields nearly naked, but the rest of the disk pretty closely covered with short and long spines. A comparison of the length of the longest arm-spines with that of the lower arm-plates gave, in eight well-grown specimens, an average of 3.1 : .6, the extremes being 5 : .7 and 2.4 : .6. In other words, the disk may have many or few spines, and may have either one or two sorts; and the arms may have spines of from four to seven times the length of a lower arm-plate, and differing more or less in shape. A young specimen had the disk 2^{mm} , arms 10^{mm} , arm-spines $.7^{\text{mm}}$, under arm-plates $.2^{\text{mm}}$; the arm-spines had five thorns on each edge; the disk was thinly covered with short spines; the under arm-plates were longer than broad, widest without, and had a notch in their outer side.

O. spiculata resembles *O. violacea* and *O. angulata*, but differs from both in the greater proportionate length of the arm-spines; from *O. Örstedii* it is distinguished by different armature of the disk, different pattern of coloration, and longer arm-spines. It is further remarkable as a *variable* species.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
147	..	12+	Panama.	.....	Alex. Agassiz.	Alcoholic.
148	..	12+	Panama.	.....	Dr. John LeConte.	Dried.
391	Panama.	.....	Dr. Sternberg.	Alcoholic.
<i>Smithsonian Institution.</i>						
1019	..	1	Panama.	.....	Dr. Sternberg.	Alcoholic.
1045	..	2	Panama.	.....	Rev. T. Powell.	"
1183	..	5	Panama.	.....	Dr. LeConte.	Dried.
1091	..	2	Panama.	.....	Mr. Edwards.	"
1095	..	1	Panama.	.....	Mr. Akhurst.	"
1187	..	1	West Coast Nicaragua.	.....	Capt. Dow.	"

Ophiothrix dumosa LYMAN.

Ophiothrix dumosa LYMAN. Proceed. Boston Soc. Nat. Hist., VII. p. 252. 1860.

Special Marks. — Upper arm-spine longest. Spines on disk of several sizes; stout. Color dull blue.

Description of a Specimen. — Diameter of disk, 11.5^{mm.}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 5^{mm.}; width of arm without spines, 2.2^{mm.}; length of arm, 72^{mm.}; distance from outer side of mouth-shield to inner points of tooth-papillæ, to that between outer corners of mouth-slits, 2.5:2.5. Teeth six, squarish, thick; cutting edge a little rounded, sometimes split in two; upper one rather narrower and more tapering. Tooth-papillæ about thirty-eight, arranged in two diverging, principal rows, between which are included some smaller ones; these two rows start, just below the teeth, with a pair of large, flat papillæ, like a tooth split in two; these are followed by a similar pair, after which the two rows diverge, growing smaller as they pass lower down, and ending in papillæ no larger than those which serve to fill in the middle space; in each of these principal rows there are about nine papillæ. The arrangement is the same in *O. spiculata*. Mouth-shields oval heart-shaped, with a decided peak directed inward; length to breadth, 1.3:1.8. Side mouth-shields rather narrower than is common in the genus, meeting within. Under arm-plates much broader than long, hexagonal, with angles more or less rounded; first four plates smaller than those beyond, and much more rounded; most of the plates on the first third of the arm are hexagonal, with

pretty acute angles; outer side sometimes a little re-enteringly curved; other sides straight; length to breadth (twelfth plate), .7 : 1.2. Upper arm-plates diamond-shaped, with inner angle truncated, lateral ones usually acute, and outer one more or less rounded; on the median line a ridge; length to breadth (fifth plate), .7 : 1.3. Brachial and interbrachial rays of disk closely beset with stout spines, of several sizes, most of them long; the longest 1.7^{mm}, the shortest .3^{mm}. There seem to be no such short spines, bearing a crown of slender thorns, and remaining permanently small, as in *O. spiculata*; but the smaller spines seem only partly-grown large ones. The largest are stout and round, and have rows of five or six thorns on their sides; they usually end in three blunt thorns; the smaller ones usually are very thick at the base, but above the first thorn grow suddenly smaller, and taper to a somewhat blunt, thorny end; these have rows of three or four thorns on their sides; the smallest spines are little, stout cylinders, ending in a conical clump of nine or ten short thorns; rarely this clump has an even top, and not more than six thorns. Radial shields nearly bare, with only a few spines on their inner ends and sides; outer ends touching each other; where they overhang the arm there is a short, narrow, raised edge, which is white; length to breadth, 3.2 : 1.6. Spines on interbrachial spaces below more slender and scattered, not extending quite to mouth-shields. Arm-spines rounded and stout at their bases, tapering regularly to a blunt point, but little flattened, ending in a crown of short, blunt thorns; thirteenth joint, eight spines; lengths to that of under arm-plate, 3.5, 2.2, 2.5, 2.5, 1.8, 1.5, 1, .6 : .7. Upper spine always longest and stoutest, with rows of about twenty-four minute thorns on its sides; it sometimes has a length of 4.5; near base of arm usually about 3.8. Tentacle-scales unusually large, though varying somewhat in size; instead of being like rudimentary spines, they commonly have the regular oval form of a true scale; length, .2^{mm}. Color, in alcohol: above, disk dull cobalt-blue, approaching lead color; radial shields lighter, each with three or four large dark spots; upper arm-plates faint bluish, with a darker spot on each side; along median line of arm, an indistinct stripe of whitish; arm-spines dark at tips; below, interbrachial spaces similar to upper surface; mouth-shields and under arm-plates irregularly edged with whitish, and spotted with dark blue.

Variations. — Another specimen had but few of the longest spines on the disk, most of them being of the second or of the smallest size; the radial shields had no distinct spots, and the under arm-plates were bright blue, with some bandings of whitish. The side mouth-shields sometimes do not meet within.

This species might be called a coarse edition of *O. spiculata*, from which it is distinguished chiefly by the armature of the disk, which is

coarser, and of a different character; the arm-spines, also, are rather stouter, and the under arm-plates more regular and angular. It is a larger species than *O. violacea* or *O. angulata*, and differs from them in coarser spines on the disk, and proportionately longer arm-spines.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
149	1049	1	San Diego, Cal.	.....	Mr. Cassidy.	Alcoholic.
338	..	1	Guayamas, Gulf of California.	.....	Capt. Stone.	"
<i>Smithsonian Institution.</i>						
1049	..	2	San Diego, Cal.	.....	Mr. Cassidy.	Alcoholic.

Ophiothrix lineata LYMAN.

Ophiothrix lineata LYMAN. Proceed. Boston Soc. Nat. Hist., VII. p. 201. 1860.

Special Marks.—Brownish red, with a black line along the upper side of the arm. Arm-spines usually six, stout.

Description of a Specimen.—Diameter of disk, 10^{mm}; from outer edge of mouth-shield to outer corner of opposite mouth-slit, 4.5^{mm}; width of arm without spines, 2^{mm}; length of arm, 63^{mm}. Tooth-papillæ fine, numerous, cylindrical, resembling short, blunt spines. Mouth-shields broad oval, with a slight peak toward mouth; length to breadth, 1 : 1.5. Disk, above, with large radial shields, which are smooth, or very nearly so, shaped like an elongated triangle, the acute angle being turned inward, separated by a distinct stripe; length to breadth, 2.8 : 1.7; the narrow brachial and broad interbrachial spaces form ten stripes, radiating from the centre; both centre and stripes are covered with elongated scales (only to be seen on dried specimens), and these again bear many little grains, each with a crown of thorns; below, interbrachial spaces quite naked. Upper arm-plates broad hexagonal, with corners a little rounded, the two side angles more acute than the others; length to breadth, .7 : 1.5. Under arm-plates nearly oval, but with some indications of angles; length to breadth, .8 : 1.2. Arm-spines rather stout, flattened, cut off square at the end, varying in length; about six in number on joints close to disk; two upper ones

much the stoutest and longest, and of about equal length, viz. 2.7^{mm}.; sometimes, however, the upper one is very short and stout; three lowest spines minute and slender, the longest not longer than .8^{mm}.; a little farther out on arm only five spines, two large, one medium, and two small. The large spines have on their flat sides diagonal rows of smooth, microscopic tubercles, which give them a wavy or corrugated appearance. One tentacle-scale, represented by a microscopic thorn. Color, in alcohol: above, disk uniform light Indian-red; arms dull purplish, with a very distinct longitudinal line of black, bounded on each side by a clear white line; spines glassy, with a pink hue; below, mouth apparatus and under arm-plates white; interbrachial spaces Indian red without, but yellowish toward the mouth.

Variations. — The number of spines sometimes rises to nine, of which five are large, and four very small. The mouth-shields, instead of being regularly oval, may have their lateral corners quite sharp.

This species may be readily distinguished from all others of Florida, by the granulation of the disk, the character of the spines, and the regular form of the upper arm-plates.

LIST OF SPECIMENS.

Catalogue Number	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
136	..	1	Florida.	.....	Prof. Agassiz.	Alcoholic.

Ophiothrix demessa LYMAN.

Ophiothrix demessa LYMAN. Proceed. Boston Soc. Nat. Hist., VIII. p. 82. 1861.

Special Marks. — Upper surface of disk, with radial shields closely covered with minute spines, bearing a crown of thorns. Arms about nine times as long as the diameter of the disk. Little thorny spines on the upper arm-plates.

Description of a Specimen. — Diameter of disk, 10.5^{mm}.; width of arm without spines, 1.9^{mm}.; length of arm, 97^{mm}. Tooth-papillæ fifteen, unusually stout, standing on a level with each other, arranged in horizontal rows of from two to four, according to size; upper ones stoutest. Teeth four, thick, stout, standing well apart. Mouth-shields much

broader than long, oval, with a faint point inward; length to breadth, .7 : 1.1. Side mouth-shields very small and narrow, not meeting within. Under arm-plates small, squarish, with rounded corners, rather broader without than within; length to breadth, .6 : .6. Upper arm-plates regular and well marked, much wider than long, wider without than within, lateral corners unusually sharp, outer side cleanly curved; length to breadth, .6 : 1.2; their surface is closely covered with minute thorny spines, like those of the disk, but smaller. Disk closely beset with short, minute spines, which are smooth on the sides, but have a crown of four to six thorns; the radial shields also are covered so as to look like the rest of the disk; below the spines are smaller, more scattered, and more pointed. Arm-spines very slender and elegant, tapering, pointed, uppermost and lowest ones shortest; on the basal joints commonly eleven; lengths to that of under arm-plate, .6, 1, 1.4, 1.6, 1.6, 1.6, 1.2, .9, .6, .3 : .6. Tentacle-scale small and rounded. Color, in alcohol: above, faint purplish-blue, arms banded with darker, and a broken stripe of the same running along the middle line; interbrachial spaces below same as above; the rest lighter.

Variations. — In specimens that have the disk-spines less closely set, the disk is seen to be covered with thin, small, rounded scales; the outlines of the radial shields, also, may be seen. The upper arm-plates are hexagonal, having the outer side in three lines. The arms in some specimens attain a length twelve times that of the disk diameter.

Ophiothrix demessa has a very soft, puffed disk, which commonly wrinkles in alcohol; it somewhat resembles *O. longipeda* and *O. parasita*, but has little thorny spines on the upper arm-plates, and is otherwise distinguished.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
151	..	1	Hilo, Sandwich Islands.	.....	A. Garrett.	Alcoholic.
334	..	2	French Frigate Shoal.	.....	A. Garrett.	"
335	..	3	Maui, Sandwich Islands.	.....	A. Garrett.	"
336	Kingsmills Islands.	.....	A. Garrett.	"

Ophiothrix propinqua LYMAN.

Ophiothrix propinqua LYMAN. Proceed. Boston Soc. Nat. Hist., VIII. p. 83. 1861.

Special Marks. — Disk sparsely granulated, and covered above with narrow scales, which form five to seven radiating rows in the interbrachial spaces. Radial shields naked.

Description of a Specimen. — Diameter of disk, 11^{mm}; width of arm without spines, 1.6^{mm}; length of arm, 125^{mm}. Tooth-papillæ standing nearly on a level with each other, thirteen to fifteen, in horizontal rows of two, or more commonly three; the lowest ones smallest. Teeth four, very thick and stout, the highest one smallest. Mouth-shields small, irregular oval, or oval heart-shaped, broader than long; length to breadth, .7 : 1.2. Side mouth-shields short and wide, not meeting within. Under arm-plates oval, broader than long, the outer side a little re-enteringly curved; length to breadth (twelfth plate), .6 : .8. Upper arm-plates pointed oval, much broader than long; length to breadth, .6 : 1.5. Disk covered above with narrow, elongated, rather indistinct scales, arranged in parallel, radiating rows; from five to seven such rows in each interbrachial space, and a single row of three or four scales between each pair of radial shields; these scales bear a few rough grains; outside each radial shield a row of roundish scales; interbrachial spaces below covered with very short spines. Radial shields smaller than usual, regular triangular, quite naked; length to breadth, 2.8 : 1.6. Arm-spines near base of arm, from five to seven, the two or three lowest very small, the larger ones swelled at the tip; lengths to that of under arm-plate, 2.2, 2.5, 2.2, 1.1, .6 : .6. Tentacle-scale very small, somewhat pointed. Color, in alcohol: above, disk bright Prussian-blue, varied with whitish; outer tips of radial shields white; arms obscurely banded with paler and darker blue; a longitudinal stripe of dark blue along the middle, and a small white spot between each pair of upper arm-plates; below, interbrachial spaces dark blue; mouth parts and under arm-plates nearly white.

Variations. — Another specimen had the disk of a more intense blue, and the white spots on the arms were nearly wanting.

This species approaches *O. nereidina*, but has more rows of scales on the back of the disk; the arms, also, are proportionately shorter.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
153	Kingsmills Islands.	.....	A. Garrett.	Alcoholic.

Ophiothrix Cheneyi LYMAN.

Ophiothrix Cheneyi LYMAN. Proceed. Boston Soc. Nat. Hist., VIII. p. 84. 1861.

Ophiothrix hirsuta? MÜLL. & TROSCHE. Syst. Asteriden, p. 111.

Special Marks. — Radial shields closely granulated; disk beset with thorny stumps. Length of arms about nine times the diameter of disk.

Description of a Specimen. — Diameter of disk, 21^{mm}.; width of arm without spines, 3.6^{mm}.; length of arm, 170^{mm}. Tooth-papillæ very close set; they form, as usual, a vertical oval, bordered by a projecting margin of about twenty-six papillæ, the centre being filled in with smaller and lower papillæ. Teeth four or five. Mouth-shields nearly as long as broad, heart-shaped, with a pretty acute point inward; length to breadth, 2.3 : 2.5. Side mouth-shields somewhat variable, more or less closely soldered to the mouth-shields. Under arm-plates partly separated by transverse furrows, rectangular, broader than long, re-enteringly curved outside; length to breadth (tenth plate), 1 : 1.3. Upper arm-plates much broader than long, oval, well marked, with a distinct longitudinal rib, sometimes a dent in the outer side, surface bearing microscopic granulations; length to breadth (twelfth plate), 1.1 : 2.8. Disk, above, closely beset with little stumps, thorny on their tops and sides, the longest of them .5^{mm} long; below, interbrachial spaces with scattered stumps, which near the mouth-shields are more pointed and fewer. Radial shields indistinct, from being covered with large, rough grains, about 35 to a square *mm*. Arm-spines nine; the third, fourth, and fifth longest, pretty stout, somewhat thickened at the point; the three under ones very small, as also the upper one, which is not always found; lengths to that of under arm-plate, .5, 2.9, 3, 3.1, 3.1, 2, 1.5, 1.2, .5 : 1.2. Tentacle-scales oval; small, but distinct. Color, in alcohol: above, disk rich Prussian blue, speckled with white; a light spot on each radial shield; arms indistinctly banded with darker and lighter blue; along the middle a fine white line, bordered on each side with

a band of blue ; below, disk pale blue, arms mottled and speckled with dark and light blue ; arm-spines transparent, nearly white ; the points of the larger ones brownish.

Ophiothrix Cheneyi stands near *O. longipeda*, but has arms only about half as long, and the upper arm-plates are oval, while in *O. longipeda* they are cleanly angular and quite smooth. It is distinguished by its large size and its broad, flat arms, bearing regular and well-marked upper arm-plates.

An examination of the original in the Berlin Zoölogical Museum (No. 1000) has shown me that Müller's *O. hirsuta* stands much nearer the present species than his description would indicate. This specimen is in alcohol, and was brought from the Red Sea by Hemprich and Ehrenberg. It has the large, puffy disk usual in *O. longipeda*. Two other specimens, dry (No. 1002), also from the Red Sea, are likewise labelled *O. hirsuta*, and, according to my notes, agree well with *O. Cheneyi*; but are *not* clearly the same species as the original above mentioned. The point must therefore stand in doubt till the specimens can be compared side by side. In the Jardin des Plantes is an *Ophiothrix* which seems the same as the original of *O. hirsuta*. It has the same puffy disk, and was brought from the same locality by Botta.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
152	..	2	Zanzibar.	.....	G. A. Cheney.	Alcoholic.
386	Zanzibar.	.....	E. Ropes.	"
387	Zanzibar.	.....	Capt. Webb.	"
388	Zanzibar.	.....	C. Cooke.	"
389	Zanzibar.	.....	C. Cooke.	"

***Ophiothrix longipeda* MÜLL. & TROSCH.**

Ophiura longipeda LAMCK. Hist. Anim. s. Vert., II. p. 544.

Ophiothrix longipeda MÜLL. & TROSCH. Syst. Asteriden, p. 113.

The original of Lamarck, in the Jardin des Plantes, is a dried specimen from the Ile de France. The arms are eighteen times the diameter of the disk. This species is a near relation of *O. hirsuta* and *O. Cheneyi*, with similar flat arms and horizontal spines. But

the angular form of the upper arm-plates readily distinguish it from these latter, which have the plates considerably curved.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
383	Society Islands.	.....	A. Garrett.	Alcoholic.
384	Society Islands.	.....	A. Garrett.	"
385	Zanzibar?	.....	Salem Norm. School.	"

OPHIOMYXA MÜLL. & TROSCH.

TYPE OF THE GENUS, *O. pentagona* Müll. & Trosch.

Disk and arms wholly covered with a thick, naked skin. No tooth-papillæ. Mouth-papillæ and teeth in the form of flattened lobes, with saw-like cutting edges. Arm-spines stout, bulging at the base, thorny at the point, covered round the base with thick skin; near the tip of the arm, the lower arm-spine has hooks along its edge. Arms rounded; arm-plates imperfectly developed. No tentacle-scales. Two genital slits, beginning outside the mouth-shield.

SPECIES HEREIN DESCRIBED.

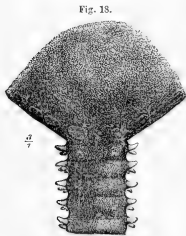
Ophiomyxa flaccida.

Ophiomyxa pentagona.

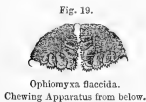
Ophiomyxa flaccida LÜTKEN. (Pl. II. Fig. 6; Figs. 18, 19.)*Ophiura flaccida* SAY. Journ. Phil. Acad., V. p. 151. 1825.*Ophiomyxa caribaea* LÜTKEN. Vidensk. Meddelelser. March, 1856.*Ophiomyxa flaccida* LÜTKEN. Addit. ad Hist. Oph., p. 138.

Special Marks. — Color, alive, lake-red or orange; in alcohol, olive green or bright green, sometimes mottled with lighter. Four to six arm-spines. Arms four or five times as long as diameter of disk.

Description of a Specimen. — Diameter of disk, 22^{mm.}; from outer side of mouth-shield to outer corner of opposite mouth-slit, 10^{mm.}; width of arm without spines, 4.5^{mm.}; length of arm, 102^{mm.}; distance from outer side of mouth-shield to inner points of teeth, to that between outer corners of mouth-slits, 4.2 : 4.6. Mouth-papillæ, four to each side



of the angle of the jaw; the outer one is, however, rudimentary, and has no saw-like edge; the others are of about equal size, but the two inner ones have their saw-like edge more coarsely divided than the second one. Teeth eight, closely resembling mouth-papillæ; the upper ones with the cutting edge more rounded and nearly smooth. Mouth-shields and side mouth-shields without distinct outline, except in dried specimens; the former are rounded diamond-shape; length to breadth about 2 : 1.7. Side mouth-shields long triangular, nearly meeting within. Under arm-plates, in dried specimens, are faintly indicated by an oval outline, with a notch in the outer side; length to breadth about 1 : 1.5. Upper arm-plates, in dried specimens, appear as transverse, elongated, oval ridges, with sharp lateral corners. Skin of the disk somewhat wrinkled. Arm-spines four, short, flattened, conical, covered nearly to the tip with



skin; their thorns numerous; second joint, one spine; third joint, two spines; fifth joint, three spines; ninth joint, four spines; lengths to that of the joint (twelfth joint), 1.3, 1.1, 1.1, 1.1 : 2. The under arm-spine, near the tip of the arm, has four or five little hooks along its edge. Genital slits short, reaching only one half or two thirds the distance to the margin of the disk, furnished with a small lobe near the mouth-shields. Color, in alcohol: above, dirty olive-green, with a few irregular rings of yellowish towards ends of arms; centre of disk

inclining to yellowish green; below, interbranchial spaces like upper surface; the other parts pale sap-green.

Variations. — The number of arm-spines varies from four to six, or even seven; and this does not seem entirely to depend on size. The color, in alcohol, is usually some shade of green, either plain sap or olive green, or bright green mottled and banded with yellowish. Occasionally the color of the upper parts is deep brownish-green. Lütken's figure, which is not correctly drawn, gives the color as red (burnt-lake). A colored drawing of the living animal, belonging to Professor Agassiz, is yellowish orange (yellow ochre and orange chrome), with a few lighter bands near the ends of the arms. Probably the color varies through several tints of red and of orange.

This species has been taken, in from three to five fathoms of water, at Santa Cruz and St. Thomas (Örsted, Riise). At the latter place Mr. Riise has found it in the holes made in corals by boring mollusks. It is not uncommon on the coast of Florida, near low-water-mark.

Say's description was evidently from a dried specimen, as he mentions the row of overlapping scales along the upper margin of the disk.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
404	Hayti.	.....	Dr. Weinland.	Alcoholic.
155	..	1	Key West, Fla.	Mh. 6, 1858.	J. E. Mills.	"
156	..	5	Florida.	.....	Prof. Agassiz.	"
157	..	1	Tortugas, Fla.	Apr. 24, '58.	J. E. Mills.	"
158	..	1	Key West, Fla.	Jan. 28, 1858.	J. E. Mills.	"
159	..	2	Cape Florida.	Apr. 1858.	G. Wurdeman and J. E. Mills.	"
160	..	6	St. Thomas, W. I.	.....	A. H. Riise.	"
161	..	12+	Florida.	.....	G. Wurdeman.	"
162	..	3	West Indies.	.....	University Museum, Copenhagen.	"
163	..	1	Florida.	.....	G. Wurdeman.	Dried.
164	..	2	.....	.....	.....	"
353	..	1	Jamaica.	.....	Amherst College.	"
<i>Smithsonian Institution.</i>						
1044	..	4	Cape Florida.	.....	G. Wurdeman.	Alcoholic.
988	..	1	Cape Florida.	1851.	.....	"
1042	..	1	Florida.	.....	.....	"
983	..	1	Tortugas, Fla.	.....	Dr. Whitehurst.	"
1076	..	2	St. Thomas, W. I.	.....	A. H. Riise.	"
1087	..	1	St. Thomas, W. I.	.....	A. H. Riise.	"
1103	..	2	St. Thomas, W. I.	.....	A. H. Riise.	"
1155	..	4	St. Thomas, W. I.	.....	A. H. Riise.	Dried.

Ophiomyxa pentagona MÜLL. & TROSCH.*Ophiura pentagona* LAMK. An. s. Vert., II. p. 546.*Ophiomyxa pentagona* MÜLL. & TROSCH. Syst. Asterid., p. 108.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
429	Alger.	.....	Jardin des Plantes.	Alcoholic.

ASTROPHYTON LINCK.

TYPE OF THE GENUS, *A. arborescens*.*

Disk and arms covered with thick skin, without scales. Radial shields extending nearly or quite to the centre of the disk, and forming more or less elevated radial ribs. Two short genital slits in each interbrachial space, lying close to the margin of the disk. Teeth, tooth-papillæ, and mouth-papillæ all similar and spiniform. Arms forked many times. No arm-spines, except at the tips of the branches, where they have the form of microscopic hooks. Tentacle-scales. Under and side arm-plates very small, and buried beneath the skin of the under side of the arm.

SPECIES HEREIN DESCRIBED.

Disk entirely granulate above ; grains flat ; ribs low,	<i>A. arborescens.</i>
Disk entirely granulate above ; ribs distinct,	<i>A. Lamarckii.</i>
Only ribs closely granulate,	{ <i>A. eucnemis.</i>
	{ <i>A. Caryi.</i>
Ribs with a few short, irregular spines,	<i>A. Agassizii.</i>
Disk above closely beset with thorny stumps,	<i>A. Linckii.</i>
Disk closely beset above with little thorny spines,	<i>A. clavatum.</i>
High ribs bearing a few clavate stumps,	<i>A. costosum.</i>

* As the specific identification of Linck's plates cannot now be made; I have taken the oldest described species, *Stella Arborescens* Rond., as the generic type.

Astrophyton arborescens MÜLL. & TROSCH.*Stella arborescens* RONDELET. De Pisc. Mar., p. 121. 1554.*Euryale costosum* LAMK. Hist. Anim. s. Vert., II. p. 538. 1816.*Astrophyton costosum* AGASS. Mém. de la Soc. Sciences Nat. Neuchatel, p. 11. 1839.*Astrophyton arborescens* MÜLL. & TROSCH. Syst. Asterid., p. 124. 1842.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
472	..	1	Mediterranean.	.....	.....	Dried.
437	..	1	Mediterranean.	.....	Jardin des Plantes.	Alcoholic.

Astrophyton Lamarekii MÜLL. & TROSCH.*Asterias caput-medusæ*? LINN. Fauna Suecica. 1761. No. 2115.*Astrophyton Lamarekii* MÜLL. & TROSCH. Syst. Asterid., p. 123. 1842.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
463	..	1	North Europe.	.....	Prof. Sars.	Alcoholic.

Astrophyton eucnemis MÜLL. & TROSCH.*Zottenkoppf* KNORR. Deliciæ Nat. Select., II. p. 34, Pl. G, figs. 1 and 2. 1787.*Asterias caput-medusæ* FABRICIUS (*non* Linn.). Fauna Grœnlandica, No. 367.*Asterias caput-medusæ* DEWHURST. Nat. Hist. Ord. Cetacea.*Astrophyton eucnemis* MÜLL. & TROSCH. Syst. Asterid., p. 123. 1842.*Astrophyton eucnemis* LÜTKEN. Addit. ad Hist. Oph., p. 70.

Special Marks.—Disk granulated. Radial ribs more or less closely granulated; the grains, in the adult, being about the size of those on the upper surface of the arms, but larger in younger specimens. Below, interbranchial spaces either apparently naked, or with very few scattered grains.

Description of a Specimen. — Diameter of disk, 87^{mm}; from outer side of madreporic shield to outer corner of opposite mouth-slit, 23^{mm}; breadth of arm inside the first fork, 20^{mm}. Distances from each fork to the next beyond : —

First	fork to	second,	19 ^{mm} .
Second	“ “	third,	17 “
Third	“ “	fourth,	23 “
Fourth	“ “	fifth,	32 “
Fifth	“ “	sixth,	28 “
Sixth	“ “	seventh,	30 “
Seventh	“ “	eighth,	27 “
Eighth	“ “	ninth,	17 “
Ninth	“ “	tenth,	17 “
Tenth	“ “	eleventh,	15 “
Eleventh	“ “	twelfth,	15 “
Twelfth	“ “	thirteenth,	17 “
Thirteenth	“ “	fourteenth,	9 “
Fourteenth	“ “	fifteenth,	13 “
Fifteenth	“ “	end,	1 “
			<hr/> 280 ^{mm} .

Distance from outer side of madreporic shield to inner points of tooth-papillæ, to that between outer corners of mouth-slits, 15 : 8. Mouth-papillæ, tooth-papillæ, and teeth, about twenty in all; sharp, rather slender, spine-like; the longest 2.5 long; those near the outer corners of the mouth-slits smaller. Madreporic shields three (there is commonly but one), like irregular, raised scars, broader than long, often broken. Under sides of arms covered with microscopic granulation, which looks smooth to the naked eye. Upper surface and sides of arms covered with distinct grains, which are pretty closely set on the upper surface, but more scattered on the sides; on the fine terminal branches they appear as a regular double row of large, prominent grains, each grain bearing a little hook; the tendency to arrange themselves in vertical rows may be noticed even at the base of the arm. Inter-brachial spaces of disk above, and brachial spaces between the radial ribs, covered with scattered grains; in the centre of the disk, grains closer and rather larger; round the margin of the disk a sort of belt of close-set grains; interbrachial spaces below apparently naked, but really covered with microscopic grains. Radial ribs moderately raised, rounded, and without sharp edges, reaching not quite to the centre; length to breadth, 43 : 9; pretty closely covered with fine grains, which are about the size of those on the arms, and are more numerous along the margins of the ribs; on the outer end, grains larger, and almost like small, blunt spines; just over the arm the end of the rib is naked. Tentacle-scales spiniform, much like the teeth in shape and size; within the disk only two or three to each pore, and on the one or

two innermost pores, none at all; outside the disk, on the chief stems and branches, usually four scales at each pore. Color, in alcohol: dark brown.

Variations.—In smaller specimens the disk granulation is more distinct and better defined; the radial ribs are very closely covered with large, rounded, regular grains, which are larger than those of the interbrachial spaces or of the upper surface of the arms. A specimen with a disk of 24^{mm}, had arms with eight forks. A young one, having a disk of 5.5^{mm}, had arms 17^{mm} long; distance from disk to first fork, 4^{mm}; first fork to second, 6^{mm}; second to third, 5^{mm}; third to end, 2^{mm}. The back of the disk was covered with smooth, close-set, rounded grains, whereof some were larger than others. The radial ribs were faintly indicated, and only at their outer end. The upper surface of the arms is covered with large grains also. Each mouth-angle carried three or four stout, conical teeth, but there were no papillæ on the sides of the mouth-angle. The tentacle-scales were also very stout. The sides of the arms bore no grains, but little, flattened spines, arranged in a row; all of them, except those at the base of the arms, bearing little hooks. A specimen with a disk of 38^{mm}, had the following proportions of the arms:—

First	fork to	second,	12 ^{mm} .
Second	“ “	third,	23 “
Third	“ “	fourth,	24 “
Fourth	“ “	fifth,	24 “
Fifth	“ “	sixth,	21 “
Sixth	“ “	seventh,	16 “
Seventh	“ “	eighth,	18 “
Eighth	“ “	ninth,	13 “
Ninth	“ “	tenth,	13 “
Tenth	“ “	eleventh,	9 “
Eleventh	“ “	end,	1 “
			<hr/> 174 ^{mm} .

This species has been dredged in four hundred and fifty fathoms, and, according to Dewhurst, even as deep as one thousand fathoms. It has been found on the coast of Greenland (Olrice and Holböhl) and at Newfoundland. *A. eucnemis* resembles *A. Caryi*, but the latter has the space at the base of the mouth-angle distinctly granulated, as also the edges of the genital slits; the tentacle-scales, also, are shorter and stouter.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
461	..	3	Greenland.	.....	Prof. Eschricht.	Alcoholic.
462	..	1	Greenland.	.....	Prof. Sars.	"
<i>Smithsonian Institution.</i>						
1067	..	1	Greenland.	.....	University Museum, Copenhagen.	Alcoholic.

Astrophyton Caryi LYMAN.

Astrophyton Caryi LYMAN. Proceed. Boston Soc. Nat. Hist., VII. p. 424. 1860.

Special Marks.—Disk very distinctly granulated above, without spines. Finer granulation at the outer side of the mouth-angle, and along the edge of the genital slits.

Description of a Specimen.—Diameter of disk, 35^{mm}.; from outer side of madreporic shield to outer corner of opposite mouth-slit, 16^{mm}.; width of arm at base, from 9^{mm}. to 13^{mm}. Distance of the different forks from each other:—

First	fork to	second,	13 ^{mm} .
Second	" "	third,	10 "
Third	" "	fourth,	22 "
Fourth	" "	fifth,	12 "
Fifth	" "	sixth,	14 "
Sixth	" "	seventh,	13 "
Seventh	" "	eighth,	9 "
Eighth	" "	ninth,	8 "
Ninth	" "	tenth,	8 "
Tenth	" "	eleventh,	6 "
Eleventh	" "	end,	1 "
			116 ^{mm} .

Distance from outer side of madreporic shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 11:5. Madreporic shield very indistinct, oval, irregular, longer than broad. Teeth, tooth-papillæ, and mouth-papillæ stout, regular, conical, about twenty-four in number; those near the outer corners of the mouth-slits rather

smaller; most of them are clustered near the point of the mouth-angle. Arms covered above and on the sides with fine grains, which are grouped near the base of the arm in irregular vertical ridges; these ridges become more regular and distinct towards the end of the arm, and on the smaller branches take the form of a double vertical row of grains; along the middle line of the arm runs a very obscure narrow furrow, in which the grains are rather more scattered. Under side of the arms covered with a smooth skin, beset with fine, scattered, smooth grains; the joints are indicated by very faint cross lines. Interbrachial spaces above, and brachial spaces between the radial ribs, sprinkled with a few fine grains, like those of the arms, but coarser. The upper and lower surfaces are separated by a raised edge, which is slightly granulated. Radial ribs extending quite to the centre, closely beset with coarse, rounded grains; length to breadth, 17:5. Interbrachial spaces below covered with a very smooth skin, which is sprinkled with fine rounded grains. Genital slits bordered on the side next the interbrachial space by rows of fine grains. The granulation of the interbrachial space extends to the base of the mouth-angle. Arm-spines all hooked, microscopic, the lowest one largest, arranged in two vertical rows; they are abundant on the end twigs, but are not found on the main trunks within the seventh fork from the disk. Tentacle-scales three, sometimes four, and within the disk commonly two; spiniform, like the teeth, but blunter; they extend within the inner end of the interbrachial space. Color, in alcohol: above, light vandyke-brown; interbrachial spaces darker; below, under surface of arm nearly white; interbrachial spaces same as above.

A single specimen has been sent from San Francisco by Mr. T. G. Cary, to the Museum of Comparative Zoölogy.

Astrophyton Caryi is distinguished from *A. eucnemis*, which it resembles, by more regular granulation of the disk, by having blunter tentacle-scales, and by close rows of grains along the edge of the genital slits.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
445	..	1	San Francisco, Cal.	.....	T. G. Cary.	Alcoholic.

Astrophyton Agassizii STIMPSON.

"The Basket Fish." Philosophical Transactions, IV. p. 1152. 1670. (J. Winthrop.)

ASTROPHYTON SCUTATUM; *scuto rotato?* LINCK. De Stel. Mar., p. 65, Pl. XXIX. & XXX. 1733.

Euryale scutatum GOULD (*non* De Blainville). Invertebrata of Mass., p. 345.

Astrophyton Agassizii STIMPSON. Inverteb. Grand Manan, Smithsonian. Contrib., VI. p. 12. 1854.

Special Marks. — Radial ribs yellowish; interbranchial spaces brownish. Numerous short, conical spines irregularly disposed on the radial ribs. Interbranchial spaces above naked, or with very few blunt, short spines.

Description of a Specimen. — Diameter of disk, 73^{mm}; outer side of madreporic shield to outer corner of opposite mouth-slit, 24^{mm}; width of arm at base, 24^{mm}; length of arm, measured along the branches to the tip of the longest branch, 260^{mm}. The distances *from one fork to the one beyond it* along the longest branch, were as follows (two branches from different arms are compared):—

From first	fork to	second, . . .	20 ^{mm}.	. . .	15 ^{mm} .
" second	" "	third, . . .	29 "	. . .	32 "
" third	" "	fourth, . . .	41 "	. . .	40 "
" fourth	" "	fifth, . . .	28 "	. . .	37 "
" fifth	" "	sixth, . . .	40 "	. . .	25 "
" sixth	" "	seventh, . . .	19 "	. . .	34 "
" seventh	" "	eighth, . . .	18 "	. . .	18 "
" eighth	" "	ninth, . . .	13 "	. . .	19 "
" ninth	" "	tenth, . . .	11 "	. . .	13 "
" tenth	" "	eleventh, . . .	9 "	. . .	11 "
" eleventh	" "	twelfth, . . .	7 "	. . .	9 "
" twelfth	" "	end, . . .	9 "	. . .	7 "
			244 ^{mm} .		260 ^{mm} .

Distance from outer side of madreporic shield to inner points of mouth-papillæ, to that between outer corners of mouth-slits, 15 : 8. Mouth-papillæ, tooth-papillæ, and teeth, about twenty-four in all, cylindrical, tapering, thorn-like; mouth-papillæ forming a row of about ten, of which those near corners of mouth-slits are smallest; length of tooth-papillæ about 1.8^{mm}. Madreporic shield broad heart-shape, with the point outward; irregular, indistinct; length to breadth, 4.2 : 6.2. Under surface of arms smooth and polished, with faint cross lines between the joints. Top and sides of arms nearly naked as far as the second fork of the arm, but beyond that granulated. Grains smooth, rounded; above, crowded; on the sides more scattered; as they approach the end of the arm they become more confined to vertical ridges, and more regular in arrangement; and at the tip of the arm

each joint has its double vertical row of large, close-set grains; along the upper surface runs a sunken line or furrow. Disk with interbrachial spaces below nearly naked, though bearing a few points not easy to see; above smooth, with a few scattered conical points; on the margin a raised edge, separating the upper and lower surfaces. Radial ribs large, prominent (particularly without), running nearly to the centre, and bearing a number of irregular grains, and low, conical points; length to breadth, 30 : 8; height (above upper surface of arm), 8^{mm}. Genital slits with two to four large flat grains along the edge next the interbrachial space, and ending without in a blunt, conical point. Arm-spines microscopic, hooked; most numerous at the tips of the branches; found in numbers as far as the fifth fork from the disk, within which point they speedily disappear; at tips of branches arranged in two vertical rows, each spine standing on a rounded grain as a base. Tentacle-scales spiniform, resembling mouth-papillæ, standing in a close row; commonly three, sometimes four, near the mouth only two or one; they extend, though fewer and smaller, as far as the inner end of the interbrachial spaces. Color, in alcohol: arms and radial ribs light yellowish-brown (near raw sienna); disk and interbrachial spaces below dark purplish-brown. The living animal has the radial ribs yellow, and the interbrachial spaces brown (Stimpson).

Variations.—A smaller specimen, with a disk of 31^{mm}, had arms with nine forks, of the following proportions:—

From first	fork to	second,	13 ^{mm} .
“ second	“ “	third,	20 “
“ third	“ “	fourth,	25 “
“ fourth	“ “	fifth,	14 “
“ fifth	“ “	sixth,	12 “
“ sixth	“ “	seventh,	16 “
“ seventh	“ “	eighth,	13 “
“ eighth	“ “	ninth,	10 “
“ ninth	“ “	end,	10 “
			<hr/> 133 ^{mm} .

The radial ribs were more regularly covered with short, conical spines, than in the adult. In the interbrachial spaces above there were scarcely any grains, but below and on the edge of the disk there were numerous fine grains. The granulation of the arms was not so close as in the adult, and was more confined to vertical ridges. A very young specimen, with a disk of 2^{mm}, had arms 4.3^{mm} long; there was but one fork in the arm, and this was at a distance of 2.2^{mm} from the disk. Except for this fork, the specimen might have almost been mistaken for the young of *Ophiopholis bellis*. The back of the disk was covered with about a dozen angular plates, which were separated by single rows of

large, rounded grains. The armature of the mouth consisted only of a single vertical row of conical teeth, whereof the lowest seemed sometimes to be split in two. The joints of the arms were constricted at the base, just as in a simple armed Ophiuran, and bore but a single row of small, hooked spines; the upper surface was clothed with large, round grains; the lower with a small, diamond-shaped under arm-plate, and side arm-plates, which met on the middle line. Two specimens, with disks of 3^{mm} and 4^{mm}, had arms with two forks, and the disk pretty closely covered with grains, so that the plates were no longer distinct.

Astrophyton Agassizii has been obtained from the Gulf of Saint Lawrence (Captain Atwood), from Grand Manan Island (Stimpson), and from Cape Cod (Captain Atwood). It is distinguished readily from *A. eucnemis* and *A. Caryi* by the short, blunt, conical spines on the radial ribs.

The following letters of Governor John Winthrop deserve notice, as showing that this singular animal early attracted the attention of our forefathers. The descriptions themselves are quite worthy of a regularly educated naturalist:—

PHILOSOPHICAL TRANSACTIONS, Vol. IV. Page 1152. 1670.

An Extract of a Letter written by JOHN WINTHROP, ESQ., Governor of Connecticut in New England, to the Publisher, concerning some Natural Curiosities of those Parts, especially a very strange and very curiously contrived Fish, sent for the Repository of the Royal Society.

"There is, besides, in a large round Box, a strange kind of Fish, which was taken by a Fisherman when he was fishing for Codfish in that Sea which is without Massachuset Bay in N. England. It was living when it was taken, which was done, I think, by an hook. The name of it I know not, nor can I write more particularly of it, because I could not yet speak with the Fisherman who brought it from Sea. I have not seen the like. The Mouth is in the middle; and they say that all the arms you see round about were in motion when it was first taken.

"We omit the other particulars here, that we may reflect a little upon this elaborate piece of Nature. The Fish, which, since it is yet nameless, we may call *Piscis Echino-Stellaris Visciformis*; its Body (as was noted by M. Hook) resembling an Echinus or Egg-fish, the main Branches a Star, and the dividing of the branches the Plant Missel-toe. This Fish spreads itself from a Pentagonal Root, which incompasseth the Mouth (being in the middle) into 5 main Limbs or branches, each of which, just at issuing out from the Body, subdivides itself into two, and each of those 10 branches do again divide into two parts, making 20 lesser branches; Each of which again divide into 2 smaller branches, making in all 40. These again into 80, and those into 160; and they into 320; they into 640; into 1280; into 2560; into 5120; into 10240; into 20480; into 40960; into 81920; beyond which the further expanding of the Fish could not be certainly trac'd, though possibly each of those 81920 small sprouts or threds, in which the branches of this Fish seem'd to terminate, might, if it could have been examined when living, have been found to subdivide yet farther. The Branches between the Joynts were not equally of a length, though, for the most part, pretty near; but those Branches which were on that side of the

Joynt on which the preceding Joynt was placed were always about a 4th or 5th part longer than those on the other side. Every of these Branchings seemed to have, from the very mouth to the smallest twiggs or threads in which it ended, a double chain or rank of pores. The Body of the Fish was on the other side, and seems to have been protuberant, much like an Echinus (Egg-Fish or Button-Fish), and, like that, divided into 5 ribs or ridges, and each of these seemed to be kept out by two small bony ribs."

Vol. VI. Page 2221. 1671.

A further Account of the Stellar Fish formerly described in Numb. 57, p. 1153.

This Account was communicated by the same Gentleman that imparted the former, in a letter written from Boston, New England, Oct. 26, 1670, as followeth :—

"Since my former I found out the Fisherman who brought that Stellar fish from Sea. I asked all the questions I could think needful concerning it. I understood from him that he never saw nor heard of any but those few that were taken by himself, which were not above six or seven in all, and those at several times, not far from the Shoals of Nantucket (which is an Island upon the Coast of New England) when he was fishing for Cod and such like Marchantable fish. This Stellar Fish, when it was alive, and first pull'd out of the water, was like a basket, and had gathered itself round like a Wicker-basket, having taken fast hold upon that bait on the hook which he had sunk down to the bottom to catch other Fish, and having held that within the surrounding *brachia*, would not let it go, though drawn up into the Vessel; until, by lying a while on the Deck, it felt the want of its natural Element; and then voluntarily it extended itself into the flat, round form in which it appear'd when present'd to your view.

"What motion these fishes had in the water could not be known to him, for the water was deep, and they could not be seen in any other form than so gather'd up together to hold fast the bait. The only use that could be discerned of all that curious composure wherewith Nature had adorned it, seems to be to make it as a pursenet to catch some other fish, or any other thing fit for its food, and as a basket of store to keep some of it for future supply, or as a receptacle to preserve and defend the young ones of the same kind from fish of prey; if not to feed on them also (which appears probable the one or the other), for that sometimes there were found pieces of Mackerel within that concave. And he told me that once he caught one, which had within the hollow of its embracements a very small fish of the same kind, together with some piece or pieces of another fish, which was judged to be of a Mackerel. And that small one ('tis like) was kept either for its preservation, or for food to the greater; but, being alive, it seems most likely it was there lodged for safety, except it were accidentally drawn within the net, together with that piece of fish, upon which it might be then feeding.

"He told me further, that every one of those smallest parts had motion when it was alive, and a tenacious strength; but after it was dead, and extended to a flat round, it was so brittle that it could not be handled without breaking some parts of it; but by carefully laying of it to dry, it was thereby somewhat hardened.

"He added, that he had taken one of this kind of fish the latter end of this Summer, but had left it with a friend at another port where he had been. Meantime he promised to procure it for me when he should sail thither again, if it were not broken or defaced. I hope I shall engage him for the future to take better notice of what may be remarkable about it. Upon occasion I have inquired of divers other Fishermen and Mariners, but can meet with none other that ever have taken any of these fishes. This Fisherman could not tell me of any name it hath, and 'tis in all likelihood yet nameless, being not commonly known as other Fish are. But, until a fitter *English* name be found for it, why may it not be called (in regard of what hath been before mentioned of it) a *Basket-Fish*, or a *Net-Fish*, or a *Purs-net-Fish*?"

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
446	..	2	Euryale Bank.	.....	Prof. Agassiz.	Alcoholic.
447	..	3	Eastport, Me.	July, 1851.	Prof. Agassiz.	"
448	..	1	Eastport, Me.	.....	U. S. Treat.	"
449	..	7	Gulf of St. Lawrence.	.....	Capt. Atwood.	"
450	..	7	Provincetown, Mass.	.....	Capt. Atwood.	"
451	..	4	Euryale Bank.	.....	.....	"
452	..	4	Provincetown, Mass.	1852.	Capt. Atwood.	"
453	..	2	Cape Cod.	.....	.....	"
454	..	1	.....	.....	.....	"
455	..	2	Cape Cod.	.....	.....	Dried.
456	..	1	.....	.....	.....	"
457	..	6	Cape Cod.	.....	.....	"
458	..	1	Cape Cod.	.....	Prof. Agassiz.	"
459	..	1	.....	.....	.....	"
438	Swampscott, Mass.	.....	Essex Institute.	Alcoholic.
439	Cape Cod.	.....	Aquarial Gardens.	"
440	Eastport, Me.	.....	Mr. Beale.	"

Astrophyton Linckii MÜLL. & TROSCH.*Asterias caput-medusæ*? LINN. Fauna Suecica. 1761. No. 2115.*Astrophyton Linckii* MÜLL. & TROSCH. Syst. Asterid., p. 122.

The citations of Martens, Linck, and Knorr, as synonymes of this species, are all mistakes on the part of Müller and Troschel. It is impossible to say whether the *Asterias caput-medusæ* of Linnæus is this species or *A. Lamarekii*.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
473	..	1	North Europe.	.....	Prof. Sars, 1852.	Dried.
474	..	1	North Europe.	.....	G. A. Cheney.	Alcoholic.

Astrophyton clavatum LYMAN.

Proceed. Boston Soc. Nat. Hist., VIII. p. 85. 1861.

Special Marks.—Radial ribs closely beset with minute, thorny stumps or spines.

Description of a Specimen.—Diameter of disk, 30^{mm.}; width of arm at first fork, 12^{mm.}; length of arm, 231^{mm.}.

First	joint (within the disk) to	second,	8 ^{mm.}
Second	"	" third,	12 "
Third	"	" fourth,	8 "
Fourth	"	" fifth,	9 "
Fifth	"	" sixth,	11 "
Sixth	"	" seventh,	11 "
Seventh	"	" eighth,	9 "
Eighth	"	" ninth,	10 "
Ninth	"	" tenth,	12 "
Tenth	"	" eleventh,	10 "
Eleventh	"	" twelfth,	11 "
Twelfth	"	" thirteenth,	11 "
Thirteenth	"	" fourteenth,	11 "
Fourteenth	"	" fifteenth,	7 "
Fifteenth	"	" sixteenth,	9 "
Sixteenth	"	" seventeenth,	9 "
Seventeenth	"	" eighteenth,	9 "
Eighteenth	"	" nineteenth,	8 "
Nineteenth	"	" twentieth,	8 "
Twentieth	"	" twenty-first,	8 "
Twenty-first	"	" twenty-second,	6 "
Twenty-second	"	" twenty-third,	9 "
Twenty-third	"	" twenty-fourth,	5 "
Twenty-fourth	"	" twenty-fifth,	8 "
Twenty-fifth	"	" twenty-sixth,	5 "
Twenty-sixth	"	" twenty-seventh,	5 "
Twenty-seventh	"	" twenty-eighth,	5 "
Twenty-eighth	"	" end,	5 "
Total length,			239 ^{mm.}

Tooth-papillæ and teeth about thirteen, regular, cylindrical, tapering, sharp, the upper ones largest, the longest 1.5^{mm.}. Mouth-papillæ about four on each side, very small, somewhat irregular. Madreporic shield lying at the corner of the interbrachial space, broader than long, plainly made up of irregular, short, thickened tubes, soldered side by side. The space occupied by the tentacle-pores and the covered under arm-plates is sunken, forming a shallow trench, the joints being indicated by obscure cross lines. Beyond the disk the joints are marked by depressions between them, their outer and inner ends are thickened on the sides, making a series of very distinct double ridges along the sides of the arm. The under side of the arm, within and near the disk, is

covered by a close pavement of flattened grains; it is very distinct from the sides and upper surface, which are beset with fine rounded grains, and are separated from the lower surface by a sunken line. Along the upper surface of the arm runs a distinct median furrow. Radial ribs running quite to the centre of the disk, prominent, their outer ends cut abruptly off, making a concave scar; length to breadth, 17:4; they are closely beset with microscopic, thorny stumps or grains, some of which end in three or four distinct thorns. The same thorny grains are found, but smaller and more scattered, on the interbrachial spaces below, and a few also on the depressed parts of the upper surface of the disk. At the tips of the arms and on the smaller twigs there are, as usual, double vertical rows of grains, bearing hooks. Tentacle-scales one or two, small, and difficult to see, extending inward as far only as the fourth fork of the arm. Color, in alcohol: above, dark purplish-brown, varied with black; below, interbrachial spaces the same; under surface of arms much lighter.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
475	..	1	Zanzibar.	.....	G. A. Cheney.	Alcoholic.

***Astrophyton costosum* SEBA.**

Astrophyton costosum SEBA (*non* Linck). III. Pl. IX. Fig. 1, p. 16. 1758.

Euryale muricatum LAMK. An. s. Verteb., II. p. 538. 1816.

Astrophyton muricatum AGASS. Mém. de la Soc. des Sciences Nat. Neuchatel, p. 12. 1839.

Astrophyton muricatum MÜLL. & TROSCII. Syst. Asteriden, p. 122.

Astrophyton muricatum LÜTKEN. Addit. ad Hist. Oph., p. 156.

Special Marks. — Disk purplish brown. Radial ribs sharply and much raised, bearing a few large fleshy spines, whose sides are often fluted.

Description of a Specimen. — Diameter of disk, 58^{mm.}; from outer side of madreporic shield to outer corner of opposite mouth-slit, 28^{mm.}; width of arm at base, 24^{mm.}. Length of arm and distances of its forks from each other, —

First	fork to	second,	8mm.
Second	" "	third,	11 "
Third	" "	fourth,	14 "
Fourth	" "	fifth,	14 "
Fifth	" "	sixth,	14 "
Sixth	" "	seventh,	16 "
Seventh	" "	eighth,	16 "
Eighth	" "	ninth,	16 "
Ninth	" "	tenth,	16 "
Tenth	" "	eleventh,	19 "
Eleventh	" "	twelfth,	18 "
Twelfth	" "	thirteenth,	19 "
Thirteenth	" "	fourteenth,	20 "
Fourteenth	" "	fifteenth,	17 "
Fifteenth	" "	sixteenth,	17 "
Sixteenth	" "	seventeenth,	18 "
Seventeenth	" "	eighteenth,	21 "
Eighteenth	" "	nineteenth,	18 "
Nineteenth	" "	twentieth,	18 "
Twentieth	" "	twenty-first,	18 "
Twenty-first	" "	twenty-second,	17 "
Twenty-second	" "	twenty-third,	15 "
Twenty-third	" "	twenty-fourth,	16 "
Twenty-fourth	" "	twenty-fifth,	16 "
Twenty-fifth	" "	twenty-sixth,	20 "
Twenty-sixth	" "	twenty-seventh,	13 "
Twenty-seventh	" "	twenty-eighth,	12 "
Twenty-eighth	" "	twenty-ninth,	12 "
Twenty-ninth	" "	thirtieth,	11 "
Thirtieth	" "	thirty-first,	10 "
Thirty-first	" "	thirty-second,	8 "
Thirty-second,	" "	end,	11 "
Total length,			489mm.

Distance from outer side of madreporic shield to inner points of teeth, to that between outer corners of mouth-slits, 19:9. Teeth, tooth-papillæ, and mouth-papillæ sharp, conical, of different sizes; about eight, which occupy the place of teeth, are the largest, and attain the length of 2.8^{mm.}; those which represent the inner mouth-papillæ are smallest; the outer mouth-papillæ extend quite to the outer corner of the mouth-slit. Madreporic shield irregular oval, broader than long, rather indistinct; placed at the inner angle of the interbrachial space. Arms covered above, below, and on the sides by a close, fine, smooth coat of microscopic grains. Below and on the sides the joints are plainly indicated by cross lines. On the upper side runs a distinct, longitudinal, sunken line; here also are scattered round spots, which, under the microscope, appear a little raised, and are made up of concentric rings of oblong grains. On the tip branches most of the grains are brought together to form a double vertical row of grains, which

bear the arm-spines, in the form of single microscopic hooks. These hooks seem only to be found on the fine twigs. Disk, above and below, covered with the same granular coat as the arms; above, also, are found the round spots in the interbrachial spaces. Radial ribs very large and prominent, ending without in a smooth, concave cicatrix; on their upper surface are numerous irregular spines, about 1.5^{mm} long, with deeply striated or fluted sides. Interbrachial spaces below very small, in consequence of the great breadth of the arms. Genital slits small, without margin of grains; length, 4.5^{mm} . Tentacle-scales very fine, slender, spiniform; they are not found at all within the ninth fork of the arm on its main trunk; beyond this point there are one, two, three, and even four to each pore, the number being greatest on the smaller side branches; on the fine twigs, however, the number decreases, and the finest have them replaced by a single hook. Color, in alcohol: above, a fine purplish umber, with fine, indistinct spots of lighter; below, pale umber.

Variations. — Instead of being uniform, the upper surface is often spotted with darker. The teeth in younger specimens are often comparatively shorter and blunter, and the spines on the radial ribs are smooth, and not so numerous as in the adult. The young of this species have, on the basal part of the arm, a few short spines or large grains. The radial ribs are low and faintly marked, and bear at their outer end a large spine, like a horn; besides these there are only one or two small spines on the disk; the first fork of the arms is not at the margin of the disk, but a little way from it; on the under side of the arms the tentacle-scales, two in number, extend inward as far as the first fork. A small specimen had a disk of 10^{mm} , and twelve forks to the arms, as follows: —

Disk	to	first fork,	3.0^{mm} .
First	fork to	second,	4.0 "
Second	" "	third,	6.0 "
Third	" "	fourth,	6.0 "
Fourth	" "	fifth,	4.5 "
Fifth	" "	sixth,	4.0 "
Sixth	" "	seventh,	6.0 "
Seventh	" "	eighth,	4.5 "
Eighth	" "	ninth,	4.5 "
Ninth	" "	tenth,	4.5 "
Tenth	" "	eleventh,	4.5 "
Eleventh	" "	twelfth,	5.5 "
Twelfth	" "	end,	3.0 "
			60.0^{mm} .

Astrophyton costosum has been found in the West Indies (Örsted, Riise, Suenson, Benzon), on the coast of Florida, at the Tortugas Isl.

ands, and at Charleston, S. C. It is fond of twining round *Gorgonia*, in which situation I have taken it on the mud flats of Key West, just below low-water-mark. When taken out of the water, it rolls up its many branches compactly. Its color, when alive, is similar to that of the alcoholic specimen, but is more brilliant, and the color of the back is more decidedly purplish.

It is very readily distinguished by the high radial ribs and their coarse spines, the long, evenly branching arms, the absence of tentacle-scales within the margin of the disk, the position of the madreporic shield at the inner angle of the lower interbranchial space.

The original "*Astrophyton costosum*, *costis conicis*," &c., of Linek, is not to be recognized as any species *now known*. Lamarck identified it with *A. arborescens*, the Mediterranean species, and was followed in the mistake by Agassiz. J. Müller considered it the same as his *A. muricatum*, and was equally wrong. Seba gives an excellent plate of the present species, and calls it *Astrophyton costosum*, which name I have kept, because it can be identified with certainty, and because it is strictly binomial.

In the Jardin des Plantes is the original of *Euryale costosum* of Lamarck (not Seba), brought by Maugé, in 1799, from the Antilles. There is a second specimen brought from Guadeloupe, in 1837, by Beaufort. What is most extraordinary, is, first, that this is neither the true *A. costosum* (*Euryale muricatum* Lamk.), nor *A. cæcilia*, nor *A. Krebsii*, the only species of the Antilles which the careful research of Dr. Lütken has brought to light; and, secondly, that this particular species bears so close a resemblance to *A. arborescens* as readily to pass for it. If it should really turn out to be a distinct species, it must receive a new name, as that of *costosum* is already taken.

LIST OF SPECIMENS.

Catalogue Number.	Original Number.	Number of Spec.	Locality.	When Collected.	Whence obtained.	Nature of Specimen.
<i>Museum of Comparative Zoölogy.</i>						
464	..	1	Florida.	.....	Prof. Agassiz.	Alcoholic.
465	..	1	Tortugas, Fla.	Apr. 2, 1857.	Capt. Woodbury.	"
466	..	1	Tortugas, Fla.	Mar. 23, 1857.	J. E. Mills.	"
467	..	2	Charleston, S. C.	.....	Prof. Agassiz.	"
468	..	1	Elliott's Key, Fla.	.....	Lieut. T. A. Crane.	Dried.
469	..	4	Florida.	.....	Prof. Agassiz.	"
470	..	1	Florida.	.....	.....	Alcoholic.
471	..	2	Key West, Fla.	.....	T. Lyman & C. Curtis.	"
442	Bahamas.	.....	Mr. Sargent.	"
443	Key West, Fla.	.....	Dr. Holder.	"
<i>Smithsonian Institution.</i>						
1065	..	3	Garden Key, Tortugas.	.....	Capt. H. G. Wright.	Alcoholic.
1066	..	2	Garden Key, Tortugas.	.....	.....	"

DESCRIPTION OF THE PLATES.

All the figures give a dorsal view, and are taken from the colored drawings in the collection of Professor AGASSIZ, made from living specimens by J. BURKHARDT and A. GARRETT.

PLATE I.

- Figs. 1, 2. *Hemipholis cordifera* Lyman, $\frac{3}{2}$.
" 3. *Hemipholis cordifera* Lyman, $\frac{3}{2}$.
" 4, 5. *Ophiopholis bellis* Lyman, $\frac{2}{1}$.
" 6. *Ophiopholis bellis* Lyman, $\frac{2}{2}$.
" 7. *Ophiura Holmesii* Lyman, $\frac{3}{2}$.

PLATE II.

- Figs. 1, 2. *Ophiothrix angulata* Ayres, about $\frac{2}{1}$.
" 3. *Ophiothrix angulata* Ayres, $\frac{3}{1}$.
" 4. *Ophiolepis Garretti* Lyman, $\frac{3}{1}$.
" 5. *Ophiolepis elegans* Lütken, $\frac{2}{1}$.
" 6. *Ophiomyxa flaccida* Lütken, $\frac{2}{2}$.

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[Synonymes are in Italics.]

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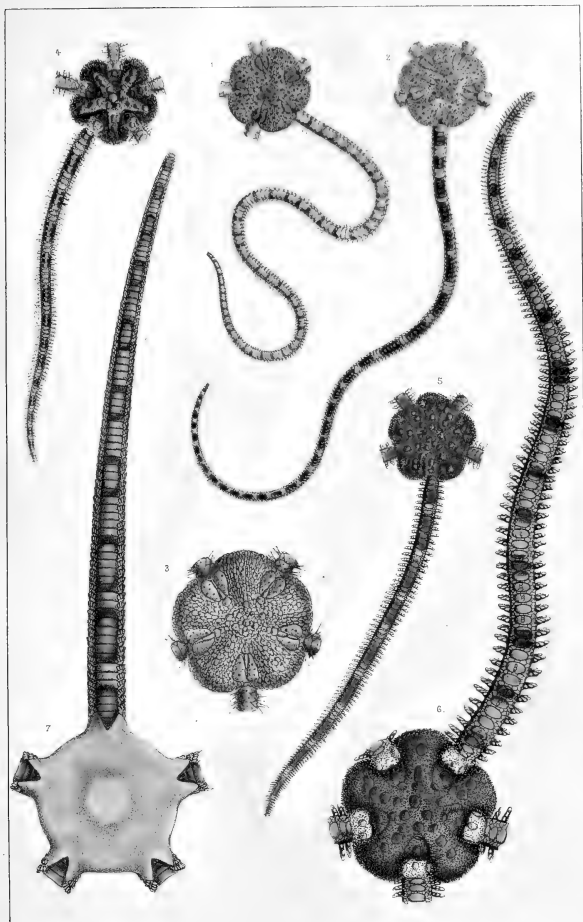
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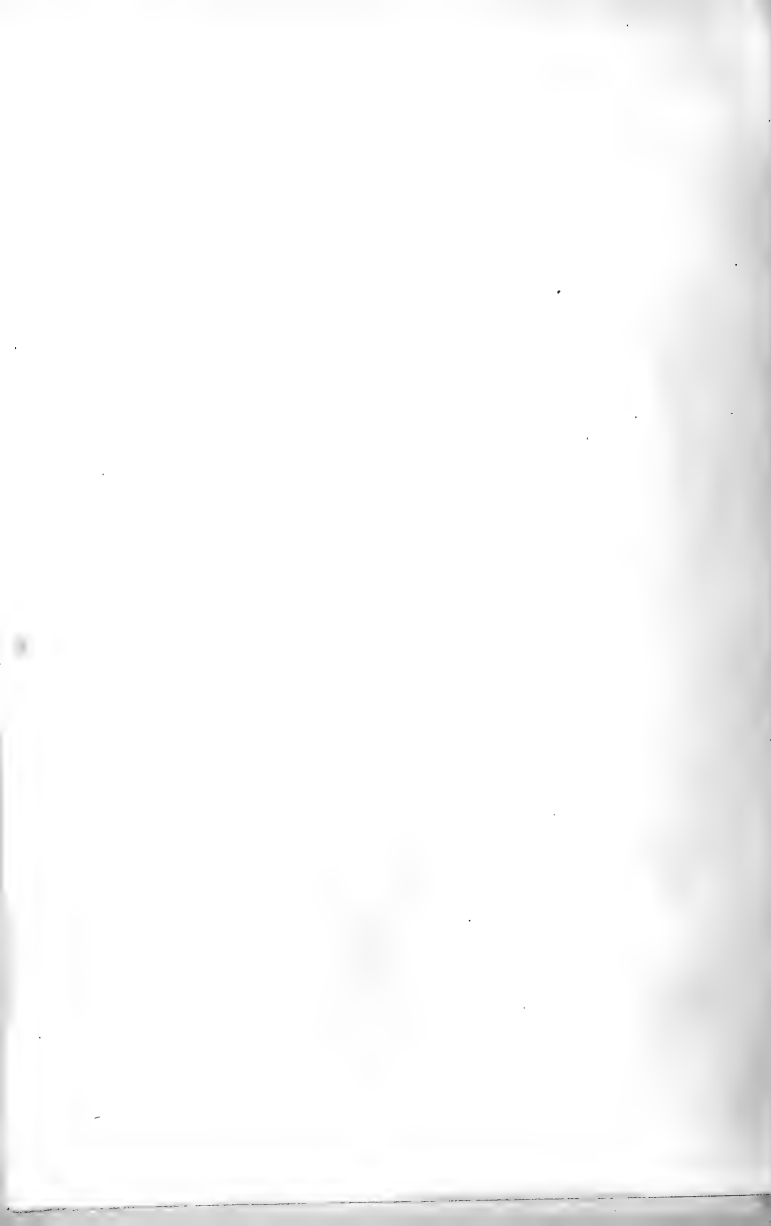
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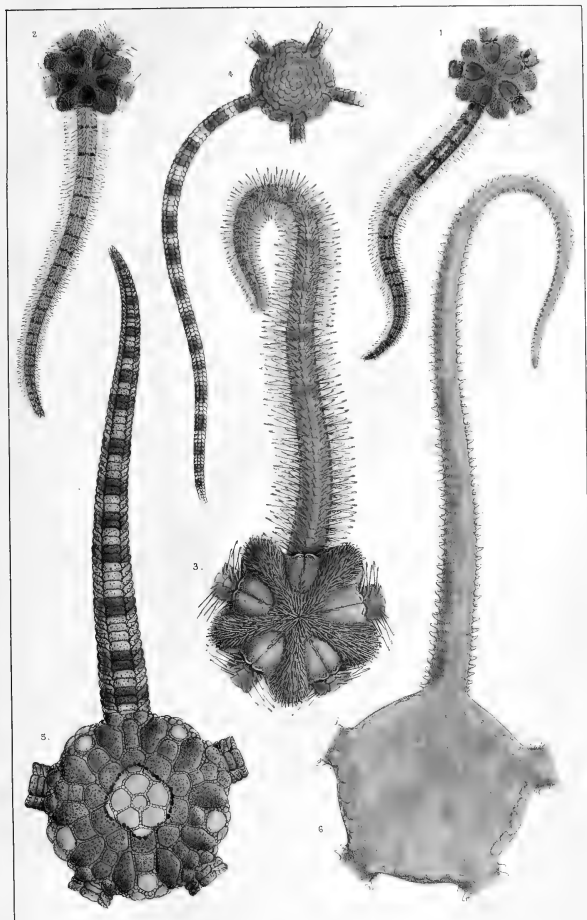


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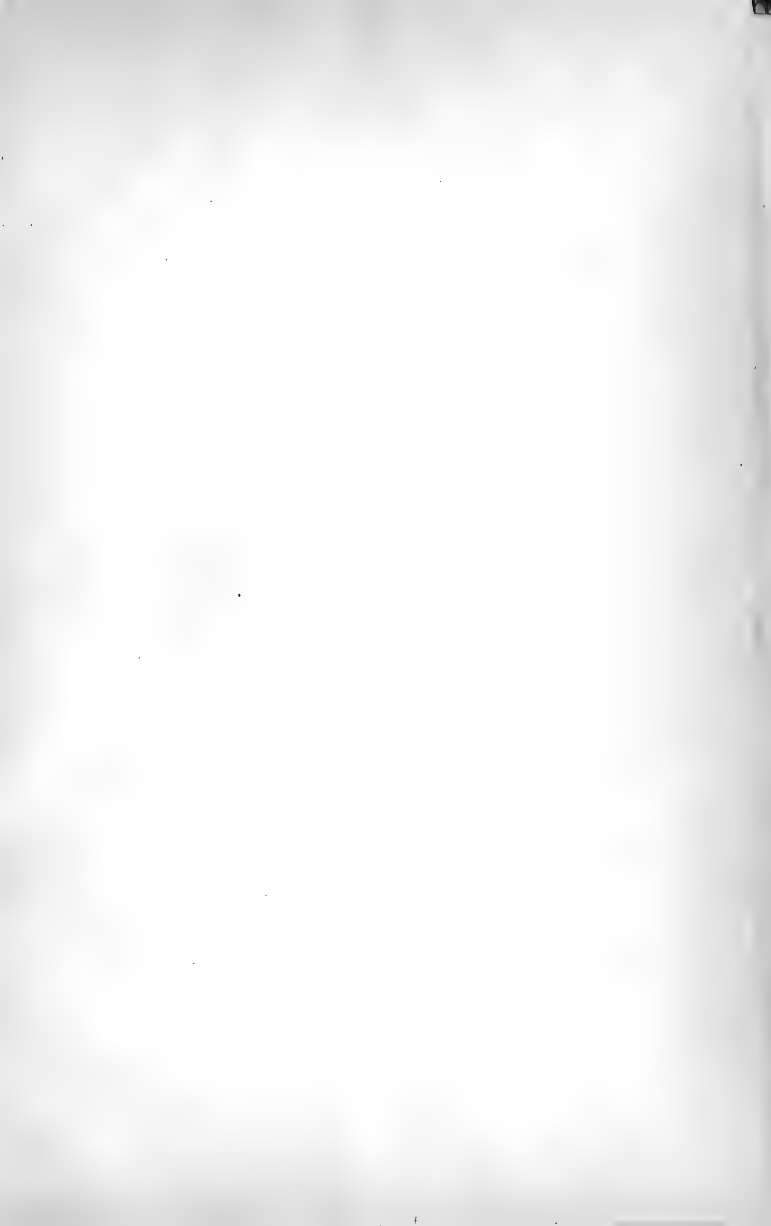


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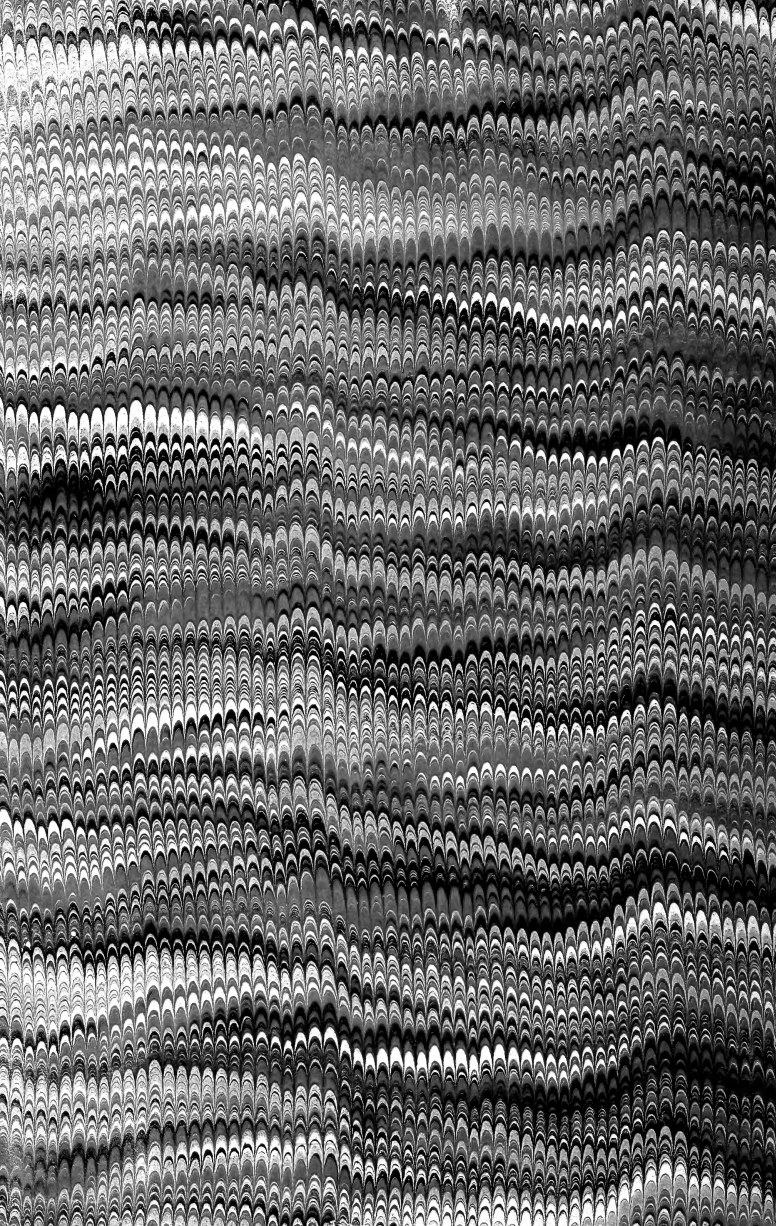
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